Computer Age

FEBRUARY 1980 ISSUE 3 60p

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PATRICIA HEWITT of the NCCL

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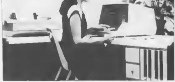

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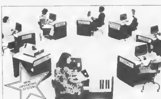

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Cover: Datamoving by Steve Vinyard

Editorial

Absolutism

You've heard of the computer freak. Now meet the computer [illegible]. He is the man who knows all the answers because he has chosen the questions. The man is impressed [illegible] his knowledge [illegible] and implacably [illegible]. He has convinced himself that what he doesn't know isn't worth knowing and [illegible] the [illegible] his [illegible] that [illegible] furiously [illegible] without [illegible] single [illegible]. [illegible] demand [illegible] mercy is a [illegible] in the face of such absolutism [illegible] can only respond by taking the [illegible] position, sit still and suffer.

While sitting, sighing and suffering, repeat to yourself the following verse from the anthology Poems from the Sanskrit *(Penguin Books)*

The ignorant are quickly satisfied
And argument will soon convince the wise
But heaven's own wisdom scarcely will suffice
To contradict a half-baked scholar's pride

Hope's glimmer

Anybody who says that union management cooperation on the effects of microelectronics "can't be done, won't be done" (and some "Not if I can help it") should have been present at a press conference held last December. It was given by Tesco, a big company with many employees. That Tesco is engaged in a massive computerisation programme for all its stores is news enough, but the real point for me was a booklet distributed to members of the press giving its views on the effects of the micro. The company is thinking ahead, but it isn't indulging in executive cerebration. Also present at the conference, and a very important figure in it, was the leader of the Union of Shop, Distributive and Allied Workers. The union spoke as a partner in the company's future.

Next let's do some multiplication across the length and breadth of Britain.

Marlene Brown

Brand News

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Editor
M[illegible] N. S[illegible]

Columnists
Martin Banks
Brian Reffin Smith, R[illegible] of Art

Correspondents
Technical Victor Nicola
Applications Marlene Brown

Editorial Advisors
Dr Martin Beer, Liverpool University
Dr [illegible] H[illegible] [illegible] University
[illegible] Southbank Polytechnic
[illegible]

Advertisement Manager
[illegible] Blackburn [illegible]
Tel [illegible]

Secretarial
[illegible]

Publisher
[illegible]

Design Consultant
[illegible]

Typesetting
[illegible] Typesetters Ltd

Artwork
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Editorial Offices
4 Valentine Place, London SE1
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THE DEFORMATION OF INFORMATION

If "the price of liberty is eternal vigilance" of what quality is eternal snooping the price?

The Rehabilitation of Offenders Act was a recognition of the fact that every individual should be able to shed certain personal information — to avoid the risk that a criminal offence committed perhaps in teenage years and left long since behind would forever bar the way to a job or promotion

But it is not only a conviction for a minor offence which can trap a person in poor housing and unemployment long after the sentence has been served We are all the potential inmates of an information prison in which the contents of a file can determine our chances of employment a home a benefit or a loan

Four key problems can be identified Information may be collected by fraudulent or otherwise unacceptable means It may be inaccurate or out of-date It may be irrelevant (albeit accurate) And information which has been properly obtained and used for one purpose may be passed on to someone else who has no such right

Surprisingly there is no effective law in the United Kingdom to control the *methods* of information-gathering In 1970, the directors of Tracing Services Ltd were convicted of conspiring to effect a public mischief by employing agents to pose as income tax inspectors DHSS officials and policemen in order to obtain official information But in 1974 prompted by an appeal from two private detectives similarly convicted of conspiracy for using a bugging device the House of Lords decided that the offence of conspiracy to effect a public mischief did not exist!

The law on telephone-tapping and other methods of surveillance is similarly inadequate In the recent *Malone* case where a defendant challenged the police use of phone-tapping transcripts the court held that British law provided virtually no protection at all against phone-tapping by the police or by private individuals and pointed out that the United Kingdom was therefore in breach of the European Human Rights Convention The Human Rights Commission decided last year in a West German phone tapping case, that such methods of surveillance were only acceptable in limited circumstances where there was provision for judicial supervision

> "We are all the potential inmates of an information prison "

The dangers of inaccurate or out of-date information have, of course, been recognised by the Consumer Credit Act which gives everyone the right — on payment of 25p — to receive a copy of the record held on him or her by a credit reference agency (although not by an internal credit department or bank) and to insist on correction of any inaccuracies Although the Act has its limitations (credit may still be refused for instance on the grounds that a former tenant of the same address had failed to pay a debt) it has significantly reduced the number of complaints received by NCCL on this issue

But with the sole exception of credit reference files inaccurate and irrelevant records are permitted to flourish in secret And the very secrecy of most government records in particular make it virtually impossible to discover how extensive the inaccuracies are What we do know is that with disturbing frequency cases come to light of documented inaccuracies in personal records NCCL took up the case for instance of a young recently graduated engineer who applied for over 70 jobs without success Having finally obtained a job he was given a contract which said that the employer knew from his references that he had a history of mental illness and that his appointment would only be confirmed after the probationary period if the employers were satisfied that he was fully recovered In fact that young man had no history of mental illness

An industrial tribunal hearing in 1978 of a Civil Service case revealed that reports on a clerical worker from two senior officers had ensured that the worker would not even be interviewed for a more senior post Suspecting victimisation for his trade union activities the clerk took the Civil Service to a tribunal obtained copies of the damning reports established that neither of the senior officers could justify their comments and won his case

Recognising the harm which can be done if inaccurate information is used to make decisions about people, the United States Congress has passed not only the Privacy Act which gives individuals the right to see and challenge most files held on them by Federal agencies but also the Buckley Amendment which specifically opens up school and college records to parents and students aged 18 or over

The dividing line between relevant and irrelevant information is fairly easy to draw in for instance the case of credit reference files It is far more difficult to draw when it comes to policing

Over the last decade a revolution has taken place in the information technology available to the British police It has been accompanied by a considerable extension of the number and nature of files kept, and the speed with which they can be made available to police officers throughout the country Political activity (which, in London at least can simply include attending 'political' meetings), homosexuality, membership of certain organisations (including, we understand, the NCCL itself), parking your car near the home of a suspect, being related to a suspect, being mentioned by a local gossip (the Thames Valley experimental police computer includes such tidbits as 'Mr So and so fancies small boys' picked up by a police officer's wife in the village shop) — all are increasingly likely to lead to your inclusion in police records. There has been no legal control, no Parliamentary scrutiny, over the criteria for police use of information. But unless we face up rapidly to the problems of determining what kinds of information about which individuals the police should keep, and what they should not, we will as a society have sacrificed individual privacy completely.

Most of this is not specifically about computers. We are concerned with the question of *information privacy* — the idea that individuals have a right to control personal information about themselves. That right clearly needs to be qualified by other social interests, such as the detection of criminals or the protection of children from battering. Information privacy is not an absolute right, but it challenges the assumption made by modern states and modern bureaucracies of a general right to uncontrolled collection and use of personal information about citizens.

The United Kingdom has seriously lagged behind other Western European

Viewpoint

countries, the USA, Canada and Australia have legislation for privacy and data protection. But the Government will soon be forced to legislate, if not from conviction, then at least from the pressures coming from the Common Market (which wants to harmonise data protection standards with the Scandinavian countries), the Council of Europe which is now debating a draft Convention on automated data files and the protection of the individual, and the British computer industry, whose development and competitiveness is affected by legislative delays.

The report of the Data Protection Committee provides a basis for UK legislation. But it would not allow the UK to sign the proposed European Convention in its present form. The Convention would, for instance, ban the recording of data on religious belief, political opinion or racial origin (except presumably with the subject's consent) and would provide a right to see and amend personal files — a matter which, under the DPC proposals, would be left to specific Codes of Practice.

Perhaps the most important question about privacy legislation is whether or not it should be confined to automated data. The last Government clearly believed it should be, and restricted the DPC's terms of reference accordingly. The Council of Europe's draft Convention only deals with computerised systems. But there are strong arguments against such an approach. The bulk of sensitive information — many personnel files, social work, medical and psychiatric records — is still held manually and may well continue to be for many years, particularly if legal controls only apply to computerised data. Any privacy law which exempts those records will be incapable of tackling the real privacy problems about which people are most concerned. And the computer industry rightly resents being picked out for legislation which would reinforce the widely held but erroneous view that computers — as distinct from the use and abuse of personal information — are the threat to privacy.

The right to know what government agencies know about you is only part of the more general right of the public to have access to government information. And both — the campaign for individual privacy, and the campaign for freedom of information — are vital parts of the attempt by ordinary people to gain back some of the control over their own lives which has been lost to the authorities. ■

Patricia Hewitt is the General Secretary of the National Council for Civil Liberties. She came over from Australia as a student, later worked as public relations officer for Age Concern, an organisation for pensioners, and began her vocation in the NCCL as women's rights officer.

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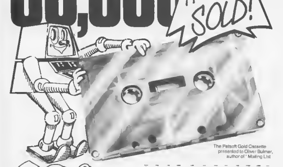

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OPTIMISING EMPLOYMENT IN THE MICROELECTRONICS AGE

Derrick Grover has been engaged in research and development in the electronics and computer industry for about 15 years. He is now an executive with responsibility for introducing new computing technology into the industry. He is married and rearing three potential employees for the coming computer age.

The current debate on the effect of microelectronics on employment is being carried on amidst a number of trends which indicate the need to review our system of employment, its incentives and security measures. Microelectronics technology is not of itself creating the problem; it is accentuating an existing problem through improvements in efficiency that will aggravate the trend.

As fewer people are needed to produce the basic necessities in the way of goods and services, so more of the remaining population will be employed in work of more limited benefit for which limited funds will be available. Insufficient funds, in fact, to compete with the existing threshold produced by unemployment pay. Basic remedies are necessary to give incentives for the able to work efficiently while maintaining a basic minimum living standard for the less able — in a way which does not impair the necessary feedback that is provided by a free market. Measures which have been introduced carry anomalies that cause a deterioration in the economy and reduce the living standards of those they were designed to protect. The answer must be in separating the measures designed to protect the unfortunate from those measures necessary for an efficient and strong economy. In the present confusion the drive for national wealth is enervated by legislation for the needy to the detriment of all.

'Microelectronics technology is not of itself creating the problem.'

An important anomaly occurs in the method of paying social security benefits. It has been pointed out by others that legal minimums for wages *have always been one of the surest methods of depriving the marginally employable of their jobs*. The social security system benefit is, in effect, in competition with the employer and, by competing for the attention of the marginally employable, it sets a de facto minimum wage. The taxpayer provides a substitute for earnings while the employer seeks to replace staff with capital equipment if the earnings are too high. The pending microelectronics revolution is destined to cause many of the employed to be replaced by capital equipment if the existing legislation continues. At least one enlightened Union leader has drawn attention to our plight if advancing technology causes unemployment at a level where the economy can no longer support subsistence payments.

Let us first make the assumption that unemployed people should be paid a subsistence allowance sufficient for them to survive with a measure of dignity. We are then faced with the reality that the saving in national terms resulting from making a person unemployed is not the salary and overheads at present borne by the employer, but the *difference* between these and the unemployment subsistence allowance. The employer, however, will act as though the full salary is saved in the short term, since the true effect is at least one step removed and only apparent in the longer term.

Industry, as the producer of wealth, ultimately pays for the unemployment subsistence. This fact should be recognised in accounting procedures when assessing the merits of labour versus capital equipment. In order for accounting procedures to be realistic and helpful in assessing an organisation's plans, they must truly reflect the value of various contributing factors, such as work performed by an employee undistorted by social benefits. Looked at from a systems-design viewpoint, the greatest efficiency (i.e. the maximum economy of effort or maximum transfer of benefit) will occur when the needs of the receiver are matched by the capabilities of the donor. The employee whose capabilities exactly match the requirements of a job will perform that job more efficiently than anyone else, this supposing psychological and external factors to be constant while the comparison is made. It will be noted that the match is a two-way requirement. A person should be capable of doing his job, and the job should provide employee fulfilment, but a person who is overqualified would have spare capacity which would give rise to frustration, and the job would return a lower rate of pay than his capabilities would warrant.

It should be the aim of employment to achieve this match. The match is most likely to be achieved when the employer can pay an employee a wage which truly reflects the contribution made for the company's benefit. The fault in the present system is that, below a certain threshold defined by unemployment benefits, the employer cannot pay a rate which is matched to the job, with the result that people, who might otherwise have performed useful work, are unemployed.

Let us now consider the objectives of our system:

- Payment of a subsistence allowance in accordance with public opinion

- A free market to decide the goods and services required
- A match between employer and employee for their mutual benefit

The third objective will only be met in the case of the lowest paid workers by nullifying the effect of the threshold. Two ways to overcome the problem are apparent. The first is to remove the threshold, which implies the unacceptable stopping of unemployment pay. The second is to raise the level of the environment to that of the threshold so that a step ceases to exist. This second solution introduces the interesting possibility of paying a basic national wage to both the unemployed (in place of unemployment pay) and the employed, with the employer supplementing this by a smaller salary, such that the employed person receives a total net payment similar to the present. On average the employer's expenditure would be the same, since higher taxes would pay the basic national wage allowance.

The important difference compared to the present is that the incremental cost of employing someone is less and it can be in proportion to the benefit of the employer rather than taking the larger step over the threshold at present determined by the social security payments. It would not then be beneficial to replace people with capital equipment *until* the equipment realised greater savings. It would not stop the progress to be expected from investing in more efficient techniques; it would simply delay those investments until they were economically feasible when taking account of the realistic costs of making people unemployed. Accordingly unemployment with its effects on morale would be less, and greater mobility of employment would be likely since the incremental cost to a company of increasing its staff would be lower. In this respect, the system would be preferable to a system of employment protection and redundancy payments which inhibit the employment of new staff. The benefit of the system in increasing employment of the lower-paid workers will also extend to the extra management and professional staff necessary for administration. The nation will benefit since the employment of people, otherwise paid to be unemployed, would increase the services and goods available to all.

The minimum salary paid by the employer would necessarily cover the extra costs of working, such as those for fares and meals, plus an incentive factor. The employer in these circumstances would not only be industry and commerce but would include those people who are unable at present to pay for such services as, for example, home decoration, window cleaning and many other jobs which could be done by people who are otherwise on subsistence, and who are suffering its attendant demoralisation. If the present trend continues, then the burden of supporting the unemployed and underemployed will prevent the majority of people from enjoying the smallest of services.

It has been argued that if labour is comparatively cheap then the employer may

Employment

not invest in the latest equipment, which would be detrimental to the national long term interest. The date at which an employer invests in superior equipment should be dictated by the interests of the company, since if it is in the company's interest, then the national interest, being that of a collection of companies, also benefits.

Investment in new equipment will not, of course, be determined by the short term view. It will depend upon benefits both in the present and in the future, bearing in mind the need to gain experience of new techniques to be competitive — especially against overseas companies. It is the job of management to draw up this equation so that the long term investment in equipment marries with the short term interest in a manner which is of most benefit to the company.

Opinions on how to equate the short term and long term interests will no doubt differ, but the realistic assessment of the opportune time for investment will not be endangered by introducing marginal costing for labour, provided the marginal costing is itself realistic and not disguised by hidden subsidies.

It is important to distinguish between a subsidy, which is a pecuniary aid aimed at selected recipients in order to soften the natural market discipline, and a basic national wage which performs the role of underpinning the employment system to provide a foundation on which to build in accordance with the nation's conscience. In the latter case the free market discipline continues to apply in order to judge what products and services the consumer really wants.

In the case of a subsidy, there is the implication that it is an activity which is not wanted by the recipient, due perhaps to inadequacies in management and labour relations, or to the type of goods and services being produced. It will be distinguished from the capital investment necessary to carry a new industry through an initial growth phase until it reaches a mature position, where it becomes self supporting in order to repay the initial investment. An investment of this nature is accordingly entered into with the anticipated market as a guiding factor. It is perhaps fitting, at a time when the small business is being encouraged, to consider the benefit of lower incremental labour costs in a start up situation. The true effect on the new company will be influenced by the tax system which, it is clear, could be modified to make or mar an entrepreneur's prospects. But whether such modifications would be considered a subsidy or the nation's investment in future business prospects is debatable.

The method of taxation required to provide for a Basic National Wage needs careful consideration. Taxation of an employer in proportion to the number of staff will nullify the effect of the scheme, and a negative income tax scheme appears to have similar problems. The Swedish experiment is a different concept. Taxation based on turnover or capital equipment may cause multinational companies, for example, to invest elsewhere. A consumer tax similar to V.A.T. appears to spread the burden appropriately without countering the advantages of the system.

It is optimistic to suppose that we can effectively control a system as complex as a national economy better than the naturally occurring forces of a free market. In the event that we wish to safeguard the population from being exploited by the unscrupulous, these safeguards should be simple and capable of being implemented without damaging the free market forces. The introduction of controls and subsidies has the effect of disguising reality and, although this may confuse the critics, it is to the disadvantage of the country as a whole.

A basic national wage for all would control the distribution of a portion of the national wealth for an adequate living standard. The wealth remaining after this distribution could be subjected to the discipline of the free market which, coupled with realistic accounting, would maximise the utilisation of our resources in human beings and equipment. ■

Editor's Note *It is interesting [illegible] Derek [illegible] UK [illegible]*

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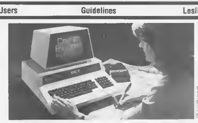


BUYING A PERSONAL COMPUTER

Solid advice by the man who started it all. Leslie Solomon is Technical Editor of Popular Electronics *magazine, which published an article on the Altair hobby computer that led directly to the boom in small systems.*

From its beginnings as an exotic, abstruse pursuit practiced by a handful of dedicated near-geniuses, personal computing has come a long way. The prospective user now has a wide coterie of manufacturers vying for his hardware and software pounds, and should he take the plunge and become actively involved he will find himself in the company of literally hundreds of thousands of computer enthusiasts. Plainly, personal computing has become sizeable business.

Boon that this proliferation of equipment and utility programs may be to the entrenched computer user, it can easily overwhelm and intimidate the beginner. This article is meant to help the interested neophyte learn what personal computing is about and give some guidance as to what sort of equipment should be purchased, should he be so inclined. Principally we will be concerned with the all-in-one "magic-box" type of computer that is easy to understand and reasonable in cost.

What is a personal computer? A personal computer is a small system with real computational capability. It is "personal" in the sense that its limited capabilities and internal resources would make it hopelessly inefficient for large commercial and/or scientific tasks. But, as we will see, it is capable of many tasks that have application in the home, not the least of which is game playing.

Physically, a personal computer is a collection of hardware that can accept data from outside, perform a specified series of operations on the data, and communicate the results to the user. Typically, input comes from a keyboard or data storage device such as magnetic tape or disk, and output is delivered to a display device such as a video monitor or printer.

The series of steps that the machine performs after receiving data and before delivering output may be complex indeed, but it is no more important for the user to understand the details of the process than to know exactly how his television set — or his digestion, for that matter — works. If he can turn on the machine, feed in the data, and follow a few fairly simple rules, he can obtain results. Systems contained in the computer itself will provide instruction.

Basic Selection

There are basically two types of personal computers currently on the market: those that are computers first and game-players second, and others reverse these priorities. Depending on your specific needs, each type can be an excellent choice. But before you buy, define your needs, check the functions and features of the various computers available.

First, determine what you want your computer to do. A home user, for example, might include in his list game-playing, recipe-keeping, telephone number files, household accounting (checkbook balancing, computation of interest on loans or on savings account balances, etc) and perhaps even *some* small-business use.

Then give your imagination a work-out and think of some 'blue-sky' tasks you might want to try. Being too conservative at the start can frustrate you later. Now you are in a position to survey the market and see what computers can satisfy you.

Among the most popular applications for a computer are "number crunching", data collection and reduction, and large-scale business and scientific uses. Usually, these extensive tasks are not performed in a home computer, although these computers can certainly be used to perform *limited* variations of these functions.

The bulk of use for home computers is in "small-scale" applications. These include, for example, music creation and generation, speech synthesis (with the computer both "listening" and 'talking' to the user), control of electrical appliances, education, household record keeping, and game playing. Generally, to perform such diverse tasks, the computer must be equipped with optional extras called "peripherals".

Depending on the computer selected, there is usually a broad selection of optional peripherals available for it. Therefore, before purchasing a computer, check out the peripherals market and select a computer that can accomodate the peripherals you want.

The following is a brief description of some peripherals available for the personal computer. Although space permits only a few brief mentions of some useful peripherals, you can obtain in-depth information on peripherals by visiting your local computer store. Whilst you are there, you can also get some "hands-on" time in with the desired peripherals to determine whether or not they suit your needs.

Music

There are several "music systems" currently available for the home computer. They do not require knowledge of how a computer works. Usually, a built-in set of instructions can be easily followed by a nonserious as well as a serious music student. Some music systems even have pro-

[illegible] spacing so that almost [illegible] be scored

In [illegible] each note and its parameters are typed into the computer via its alphanumeric keyboard The computer then stores the keyed in information for later playback Most systems also give control over the parameters of the music so that all types of special effects can be created in a manner similar to that used in conventional music synthesizers

Unlike a conventional audio recording playback the digitized playback can easily be "massaged" to play at any speed without changing the pitch or other parameters, and any element within any measure can be altered to suit the user's whim of the moment

If music is one of the major uses to which you wish to put your computer find a computer that offers this option. Not all computers do

Speech

This is another option not offered with all computers A speech input system can be used by people interested in the elements of speech, speech control of external devices security systems that respond to only one person's voice or as an interesting adjunct to game playing

Present-day speech-input peripherals accept voice or other sound input and convert it into a digital "code" that is stored in computer memory The computer is "told" (in the speech system's built-in instructions) what to do when it detects that sound again For example, it can be programmed to print on the video screen what is said Alternatively, it can input the spoken word as a command in a game displayed on-screen Speech input can also be used to control radio-controlled cars with suitable plug-ins

Since speech-input systems must be "trained" with a voice, a security system can be created This opens up many interesting possibilities for the home experimenter

Guidelines

Speech-output devices are used to give the computer a voice Most low-cost speech output devices are divided into two areas those with a built in table of words "speak" very clearly while those that can be programmed to "say" anything (phoneme oriented) do not as yet speak clearly although they are understandable Both are currently available

Speech-output devices are used to verbalize games, teach letters, words and sentences to preschool children, or just chatter away as the user desires

The uses of literary

Control

Providing a computer with a control peripheral and the proper program, a number of electrical appliances scattered around a home office etc can be controlled from a central location

There are basically two types of computer control systems wireless and hard wired Each is essentially the same in that the control peripheral plugs into the computer and communicates under software control with selected remote units In the wireless system the computer control unit "speaks" to the selected remote by using the ac power line as the interconnecting cable in the same way wireless intercoms communicate with each other

The remote has a built-in "receiver" that decodes the data on the ac line and acts accordingly This approach does not require rewiring the premises since ac line power is available in all rooms where an electrical appliance requires control

As its name implies the hard wired system uses separate electrical cable to interconnect the computer with its remotes The advantage of this approach is that it eliminates the possibility of ac line noises from creating decoding problems

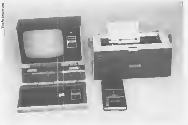
Using a control system it is possible to create vacation programs wherein the computer turns on and off various lights radios etc , at different times of the day to give a possible intruder the impression that someone is home

Some control systems have telephone interfaces that allow you to communicate with your computer via a telephone Too small pushbutton switches can be strategically located around your house to allow you to control lights and appliances without having to go to the computer's keyboard

Modems

Among the literally dozens of useful (and not-so-useful) computer peripherals available is the inimitable modem This useful peripheral is a device that allows a computer to communicate over a conventional telephone line It can come in mighty handy for the small businessman who wishes to enter or retrieve data even when he is many miles from his computer It can also be used to allow program "swapping" by hobbyists situated many miles apart

Yoshi Imamura



The unmistakable TANDY TRS-80

The most common hardware options are hard-copy printers and disc systems. Let us discuss each of these items in turn.

A hard-copy printer is a form of electric "typewriter" that is driven by the computer and is capable of printing the desired output on paper. There are many types of printers. They are usually expensive items, most costing as much as the computer with which they will be used.

Printers connect to what is called a "serial output port." Consequently, if you are planning a printer option, make sure the computer you select has a suitable 20-mA or RS-232 port.

Your choice of printer depends to a great extent on what you wish to print. Assuming you feel you need a printer, there are a number of factors to bear in mind. These include type of printing font desired, number of columns (characters per line), number of copies, printing speed, type of paper, type of paper feed, available forms, etc. There are far too many details to spell out in this article. The best suggestion is to consult your local computer dealer.

Most personal computers come with a built-in cassette interface. This is a low-cost approach for feeding programs into a computer and recording outputs from a computer. In keeping cost down, the cassette interface exacts a toll — time. Since a cassette is a serial storage system, it may require some time to search an entire tape to locate a specific program. A computer can be made to search the tape, but in most cases it cannot rewind the cassette to start from the beginning. However, the advantage of the cassette medium is that it costs only a fraction of a floppy-disk system. So, if you are on a limited budget and do not require random-order program or data retrieval, it might pay you to stay with the cassette.

Keep in mind that cassette recording schemes are not the same for all computers. Programs written on one make of computer may not work on a different machine. There is no tape "standard."

A disc system has two interdependent advantages — random access and speed. With a disc system, all you have to do is "name" the program, using the computer's keyboard, which is enough to store or retrieve data within a second or less.

Two different types of floppy-disc systems are currently in use. Operating on the same principle, their basic difference is in the size of the discette itself. Most popular and less expensive is the 5¼" (133-mm) system. The 8" (203-mm) system has the capability of storing considerably more data than the smaller diskette but is priced commensurately higher for both drive and discettes. There are also disc systems that offer "double" and "quadruple" densities, which means more data storage on a single discette (and a much higher cost).

Not all computers can use a disc system. For a computer to do so, its operating system (commands the computer can perform) must also include disc commands. In addition, there is a hardware requirement for a disc. Again, make certain the computer you have in mind has provisions for adding a disc system.

Like cassette recordings, discettes written by one machine will not work on another. There are many factors involved here, including hard- and soft-sectoring and the disc operating system.

The only language a computer understands is "machine language," which consists of a binary arrangement of 1s and 0s. However, other languages have been developed to allow you, the user, to communicate with your computer in a more or less human language. BASIC (Beginner's All-purpose Symbolic Instruction Code), developed at Dartmouth College, is the language most commonly built into personal computers. This "high-level" language converts the computer's "low-level" machine language into a human-understandable form (English in our case). In a sense, it is an "interpreter" between man and machine.

Languages

Programming details that come with every computer illustrate how to write BASIC programs, but only for the given computer! Bear in mind that there are many versions of BASIC, each with its own unique differences. This means that if you copy programs from a book or magazine, they may have to be adjusted (de-bugged) before they work properly.

A computer can communicate in any high-level language written in its own machine language. It is possible to have a computer working in any number of languages, one for each different type of programming. For example, you can use BASIC with some programs, FORTRAN with others, etc. Actually, so long as software is available to do the things you want it to, the language you use is not really very important.

Some computers come with their languages built into them in ROM (read-only memory that retains programmed data even after power down). Others retrieve the language from a cassette or disk. Whichever method a manufacturer uses, it is acceptable if it lets you communicate with your computer.

What to look for

In personal computers, you have a choice of either an "all-in-one" system or a "components" system. In the former, the manufacturer chooses the computer and input/output devices and sells them as a "package." The user can rarely alter such a system. The components system allows the user to select his computer and any of a number of compatible peripheral devices. Expansion is relatively easy and inherent to the components system.

When looking to expand a component computer, the first thing you must keep in mind is the method of expansion. One approach is the "bus" system, such as the S-100 and S-50 popularly used by a number of manufacturers, and some manufacturer-unique buses. Individual manufacturer buses have been "standardized," which means any plug-in, even those made by other manufacturers, will work. The S-50 bus is just about standardized and will work with any plug-in designed for it. The S-100 bus is another story altogether.

Controversy over the S-100 bus arose because it had too many unused connections and was never standardized. While there are literally hundreds of different plug-ins for the S-100 bus, not all will work in all S-100 computers. Keep this in mind when you are out shopping for a computer system.

A second expansion approach is a unique (to the manufacturer's particular computer) electrical connector usually located on the rear of the machine. Foreseeing future expansion, the manufacturer will use this connector to hook up any peripherals he may produce. Since the company itself will be manufacturing these peripherals in most cases, there will

[illegible] things personally at the Byte Shop, Tottenham Court Road, London usually be very few plug-ins available for this type of computer

Input/output (I/O) ports offer another opportunity for expansion. Such ports can be either serial or parallel. Serial ports have been standardized and have provisions for either 20-mA current, RS-232 voltage, or both. A current port can be used with some types of printers, terminals, and control interfaces, while an RS-232 'loop' is used with most video terminals, modems, and some types of printers. Ports are baud rate (speed) limited but sufficiently fast for most users.

Parallel ports are high-speed I/Os that accept or dump data as fast as a computer can handle it. They are used with certain graphics and other high speed interfares.

Also keep in mind the type of video display to be used with your computer. Some computers call for a video monitor while others are used with a conventional TV receiver and an r-f modulator. In the case of the latter, all you do is connect the computer to the TV receiver's antenna terminals via the modulator and tune to the correct unused channel.

The video monitor system produces the best display but requires you to invest in a separate monitor. The receiver approach, although low in cost because you do not have to buy a monitor, is bandwidth-limited and may produce only a passable image on-screen. (Although a TV receiver can produce what appears to be a sharp image with conventional TV transmissions, it will not clearly display a computer-generated image, except perhaps for games.)

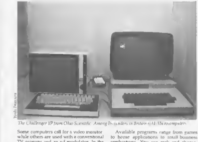
Due to the limited electronic requirements of a TV signal, a computer display of 40 to 60 characters across the screen and about 16 lines deep is about the limit for a clean, crisp display. Keep this in mind, especially if you plan to use your computer in a small-business installation.

If you select a computer that can create colour graphics, the only economical way

Guidelines

to go is a colour TV receiver. While they are available, colour monitors generally cost as much as a colour receiver but they do offer superior displays. Obviously colour adds an extra dimension to graphics programs and games.

Without the proper software, a computer is useless. Software is the information the computer requires to perform a given task. Fortunately, there is no lack of available software, available on cassette tape or floppy disk or, in some cases, on plug-in modules. Many magazines and books publish short programs that can be entered via the computer's keyboard.


Yoshi Imamura

The Challenger 1P from Ohio Scientific. Among Its vendors in Britain is U Microcomputers

Available programs range from games to home applications to small business applications. You can pick and choose. But, again, make sure the software you choose will work with your particular computer.

Computer Stores

No matter where you buy your computer, make careful note of where your local computer store is located and pay it a visit. Buying from the computer store itself puts at your disposal (for a fee, of course) someone who understands your machine and who can answer your questions on hardware and software. And should your computer ever fail to operate properly, the computer store's service facility can get it back into operational order in relatively short time.

Most computer stores are 'community centers' for computer people. Here is one place you can be sure of meeting others who share your interest in computers and pick up lots of good information from owners of other small computers. Here is where you can keep abreast of the latest in hardware and software and possibly learn programming 'tricks' that can help you

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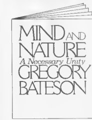
SHAPES, FORMS, RELATIONS



[illegible] E M Forster said Only connect [illegible]

I wrote last month that I wanted to review Mind and Nature the new book by Gregory Bateson I should have put the word review in quotation marks I am not re viewing the book which purports to be about evolution as mental process Rather, I m writing, and thinking about it and going off into areas of my own including computing and art areas more or less simultaneously — certainly freshly for me

Also if it is true (and Bateson frequently asserts that it is) that the map is not the territory then *a fortiori* the review is not the book

"Mind and Nature a Necessary Unity" has already received some rather mixed reviews notably from *New Scientist* and the *New York Review of Books* This is not all that surprising Bateson at home in philosophy biology systems theory psychiatry anthropology and so on casts his net widely and sometimes this makes splashes and little waves that can make it appear as if he s just thrashing around Certainly he's not just catching fish though to push the analogy too far he does come up with pearls *en passant* (Those who may have detected an overzealous use of foreign phrases epigrams and *bon mots* (lord, there we go again) can just shut up — I m trying to cut down)

What you will be muttering what connection has this man Bateson and his book with the Computer Age? Ooh ever so much honest

Listen — what I ve tried to do is to read the book on two levels The first is my own sort of whole emotional level It's very difficult to think about and pointless to write about, when you can — if you read the book — construct and operate upon your own quite adequately (This you might be able to do free since as you'll see later I m offering the price of the book as a prize in a little competition)

The second level is that of pin pointing particular valuable insights metaphors facts and opinions which seem to me to leap out of the page at least as often as from any computing book that I have read This approach whilst ignoring both a message of the book and common sense has the virtue of smoothing various of my ruffled feathers ruffings caused by some things he says and avoiding uncomfortable higher-level reconstructions that might threaten the usefulness of the particular insights etc This long sentence that is to say is a cop-out At least I'm honest

The book deals with a new way of thinking about the world around us as the publisher s blurb says On the way towards its conclusion that biological evolution is essentially a mental process Bateson deals with no less than sixteen

common misconceptions or presuppositions that he thinks we should clarify in a chapter called Every schoolboy knows Sections include Science can never prove anything , and 'There is no objective experience Quite But it is also in this chapter that I found some disturbing assertions and theorems advanced in ways that were both irritating and to me wrong

Then he continues with a study of how to think about thinking and winds his way to a conversation with his daughter called So what?' via treatments of naming language process relationship, aesthetics parts wholes quantity quality and a great deal on tautology

> "A miracle is a materialist's idea of how to escape from his materialism "

I told you something about the limitations of imagining he tells his daughter so that you cannot imagine the world as it is (And why stress that little word?) And I told you something about the self validating power of ideas that the world partly becomes — comes to be — how it is imagined

Some other pronouncements which for me are slap-bang in the area of the use of electronic embodiments of aspects of mind (I mean certain uses of computers)

A miracle is a materialist's idea of how to escape from his materialism

Purpose appears as the universe is dissected

Why do schools teach almost nothing of the pattern which connects? Is it that teachers know that they carry the kiss of death which will turn to tastelessness whatever they touch . . . What's wrong with them?

And in the context of showing a freshly cooked crab to some art students, and asking them to produce arguments to show

Gregory Bateson

Discourse

that it was once a living thing . . . If they observed that one claw was bigger than the other . . . somebody would say *one claw is bigger than the other but both claws are made of the same parts*. Ah, what a beautiful and noble statement . . . the speaker politely flung into the waste-basket the idea that size could be of primary or profound importance and went after the *pattern which connects* . . . Never quantities, always shapes, forms and relations.

Yes, and is there not a message here for those who approach computers as that which they can do with a hesitation born not of all the sensible things that it could be born of, but of fear of "the maths" and numbers and things? Never mind those! (Especially the "things".) As Bateson has been saying for years — information is a difference that makes a difference. Distinctions, differences, are of a higher order than the "things" which in relation to one another (only that) give rise to them. Parts indeed! I told you it was a cop out.

Oh, blow the detail. He came to the Institute of Contemporary Arts in London some time ago. Certain people talked to him all evening, yet they seemed confused. As he says to his daughter, "You wouldn't have asked this question if you'd been in love."

I know someone who said not one word to him, but sat with her arm around him and his round her, as he nodded and smiled politely to the others. Hugging on the way out, she was weeping, and knew some things.

All I can tell you from the book is that it has to do with things you think and do. Sorry if that's fuzzy and not immediately computable. Explanation, Bateson says, is the mapping of description onto tautology. I've tried to do that a bit, but it depends so much on our common acceptance or perception of the tautology: that which we take as true.

Here, in this computer magazine, let tautology, for you and me, take the place of anything that we may not share. Let us pretend, in case it's true, that we are good about computers, and what we do.

The book is *Mind and Nature* by Gregory Bateson, published by Wildwood House at £7.50. If you will write to me at the Royal College of Art, 24 Kensington Gore, London SW7, I will send a book token for £7.50 to the person who, in the opinion of myself and various enemies and friends, most pleasantly suggests how we can get away from *quantity* in teaching or public discussion of computing towards quality, shapes, forms, relations and the "pattern which connects".

It might be an idea, a program outline, a brief description of an artwork or textbook or course — I don't know. Keep it short and send it to me, not to *Computer Age*, who are busy enough. I can't return entries, so don't send anything you'd want back. Thanks. ■

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CRA

This article is the third from a member of the Advisory Unit for Computer Based Education, St Albans, Hertfordshire.

USING A MICRO

> "The more linear the subject then the greater the problem."

Computer Managed Learning (CML) is an area of educational computing which produces a lot of research but very few working examples. This is particularly true in secondary schools where large numbers of pupils and severely limited finance have produced only a tiny number of successful projects. There is also a certain amount of customer resistance to CML due largely to the ill fated programmed learning experiments. Although CML owes little or nothing to programmed learning on the fact of it they both seem to be doing the same type of thing. The difference is that programmed learning tried to provide a *complete* learning environment and hence failed, whereas CML is simply a management *tool* with the teacher as the manager.

This view of the teacher as a manager becomes important when the teacher accepts the need to treat pupils as individuals rather than as a uniform class. This need arises particularly in mixed ability classes, but with falling rolls, the average setted class in secondary schools is likely to become an even more amorphous mixture. Once a teacher views each pupil as learning independently of the rest of the class (although small transient groupings will occur), he is faced with the problem of managing these 30 independent learning situations.

It is worth noting that although this individualised approach ought to apply to any subject, it is clear that the management problems are much more acute in some subjects than in others. A first approximation would be to say that the more linear the subject then the greater the problem. It is worth discriminating between local linearity and global linearity and it is the *local* linearity which causes the immediate problems. Simply, if a pupil will be unable to grasp concept B without having first mastered concept A then there must be some interrupt between the natural progression from A to B to check that the pupil can sensibly be allowed to proceed.

The major problem with implementing a CML system is the initial cost threshold. It is also clear that CML is likely to cost more to run and there is usually not enough money in secondary schools to run the existing courses. However the initial cost threshold is the greatest barrier and these costs come in 3 parts

- **i) course material**
- **ii) software**
- **iii) hardware**

By far the most expensive is the course material since it will almost certainly have to be written as an integral part of the CML system. Secondly comes the cost of software and finally the hardware costs. Of course, if the project is successful and is used more widely then hardware costs become more dominant because the other two items are a once and for all cost (except for continued development).

So, to justify these costs, particularly the fixed hardware costs, the CML system must cater for large numbers of pupils for a large part of a course. The problem arises because, to spread the costs over sufficient numbers of pupils, and for sufficient length of time for the system to become cost effective, there is a minimum total cost threshold below which, although the total costs can be slightly reduced, the cost per pupil hour is unacceptably high. Here CML is unlike CAL, where it is usually possible to keep slimming the size of the package until the total costs fall within the available budget without reducing the package to the level of absurdity. CAL is also at an advantage because it is usually possible to implement it using existing hardware.

One CML system, which is currently running in 15 schools, began life in 1973 as part of the National Development Programme for Computer Assisted Learning. This project, the Hertfordshire Computer Managed Mathematics Project, originally used a mainframe computer, and has recently been implemented on a microcomputer. Six schools, in 3 L.E.A.'s are currently running the system on a microcomputer in their own school. The remaining 9 schools in Hertfordshire are using a central mainframe, with a twice daily courier van. The original project was jointly funded by NDPCAL and Hertfordshire County Council. It is a 2 year mathematics course for 11 and 12 year-olds which is designed for use in a mixed ability classroom. It consists of 25 independent modules (chapters), each made up of approximately 12 worksheets. The material is structured so as to get progressively more difficult. Pupils in a class will all be doing the same topic but will progress at their own pace.

Schools

Approximately 2/3 of the worksheets are computer marked. Pupils code their answers to these sheets on to mark-sense cards which are then marked, either immediately or before the next lesson. The computer is involved in three ways.

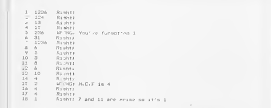
- To assess the pupil's work — this includes diagnostic comments where answers are wrong
- To schedule pupils within the structure, to remedial or extra practice sheets as appropriate
- To provide adequate feedback to the teacher on individual pupils' progress ►

The microcomputer system runs in two modes

1 *BATCH*
Here all the pupils' cards are collected together and fed into the computer at the end of the school day. The computer marks each pupil's answers, prints out these answers with appropriate comments and also produces the register for each class ►

2 *CAFETERIA*
In this system the computer is left running during the maths lessons and as each child completes the card he/she 'posts' the card into the card reader. The computer marks the card there and then and prints out the answers and appropriate comments. This process takes about 15 seconds. The pupil then tears off his/her piece of printout and returns with it to the classroom. The register for each class can be printed out at any time during the day.

The following is a sample of the printout for an individual child (see figure)



```
  Jill Gordon              GM71X          Worksheet  C2M               1X


   1  1236   Right!
   2  124    Right!
   3  13     Right!
   4  15     Right!
   5  236    WRONG, You've forgotten 1
   6  31     Right!
   7  1236   Right!
   8  6      Right!
   9  5      Right!
  10  3      Right!
  11  8      Right!
  12  6      Right.
  13  10     Right!
  14  4      Right!
  15  2      WRONG! H.C.F is 4
  16  4      Right!
  17  4      Right!
  18  1      Right! 7 and 11 are prime so it's 1


  TOTAL MARK 16 OUT OF 18                             DO WORKSHEET  C2S
```

C2M is a worksheet in Module 2. The answers here are all numeric, but non numeric answers are also accepted.

C2S is an optional worksheet, which the computer has scheduled the pupil to, on the basis of the mark on C2M. The scheduling and response comments are decided at the time that the worksheets are written, and are kept in data files on the computer.

The typical configuration for a school to run the system independently, is a Research Machine's 380Z microcomputer, with mini floppy disks, a Hewlett Packard mark-sense card reader and an Anadex printer. The software has several versions to allow for the use of alternative peripherals.

The whole system is still under development, particularly to allow for a greater degree of scheduling. However the package, particularly in the cafeteria mode allows the class teacher to monitor the progress of individual pupils without forcing them to work at the same pace, and without the management of 30 independent learning situations becoming his dominant problem. Instead, the teacher is freed to help pupils with their actual learning, the most essential part of his job. ■

Computer Age *welcomes articles from school teachers who have implemented or are in the process of implementing micro computer usage*

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03 = *ENTER PURCHASES
04 = ENTER A/C RECEIVABLES
05 = *ENTER A C PAYABLES
06 ENTER/UPDATE INVENTORY
07 = ENTER/UPDATE ORDERS
08 ENTER/UPDATE BANKS
09 EXAMINE/MONITOR SALES LEDGER
10 = EXAMINE/MONITOR PURCHASE LEDGER
11 = EXAMINE/MONITOR (INCOMPLETE RECORDS)
12 = EXAMINE PRODUCT SALES

SELECT FUNCTION BY NUMBER

13 = PRINT CUSTOMER STATEMENTS
14 = PRINT SUPPLIER STATEMENTS
15 = PRINT AGENT STATEMENTS
16 = PRINT TAX STATEMENTS
17 = PRINT WEEK MONTH SALES
18 = PRINT WEEK/MONTH PURCHASES
19 = PRINT YEAR AUDIT
20 = PRINT PROFIT/LOSS ACCOUNT
21 = UPDATE END MONTH FILES MAINTENANCE
22 = PRINT CASH FLOW FORECAST
23 = ENTER/UPDATE PAYROLL (NOT YET AVAILABLE)
24 = RETURN TO BASIC

WHICH ONE? (ENTER 1-24)

01 SUB MENU EXAMPLE: 01 = EXAMINE 02 = INSERT 03 = AMEND 04 = DELETE
05 = PRINT (1,2,3) 06 = NUMERIC COMBINATIONS 07 = SORT

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George Gerhold &
Larry Kheriaty

[illegible] Gerhold is Professor of Chemistry and [illegible] is [illegible] Programmer at [illegible] Washington University, Belling[illegible] USA. This series of articles will [illegible] a short course on COMMON [illegible] specifically designed for [illegible]

MICROCOMPUTERS IN CLASSROOMS

Part One

> *"The only way to achieve long-range acceptance and success of an innovation is to involve the teachers in the creation of the innovation."*

The availability of relatively low cost microcomputers has transformed the idea of the classroom computer from a pipe dream into a possibility. An [illegible] description of the ideal learning situation is President Garfield's [illegible] with only a simple bench, Mark Hopkins on one end and I on the other. In tax supported schools those furnishings may be approached but the economics of that ideal teacher student ratio are utterly prohibitive. For the first time in the history of mass education the computer allows us to move towards that ideal, to have each student interact individually with an extension of the teacher for a portion of the student's instruction. It is essential to understand that the computer can function effectively only as an extension of the teacher. The terminology which used to describe this application of computers (in England Computer Assisted Learning or CAL and in North America Computer Assisted Instruction or CAI) is somewhat misleading because it obscures the fact that the teacher still functions as the primary resource in the educational process.

In comparison with the traditional computer installations the classroom is an unusual environment for the computer: the types of programs are different, the users are drawn from a different population, and the operators and programmers have almost no computer sophistication. In spite of these differences standard hardware can be used, but different systems software, special hardware combinations and special training programs for teachers must be used. This article then divides naturally into three parts:

- system software or author languages
- hardware requirements
- examples and classroom implementation

Our analysis of classroom computing is based on our experiences with CAI at Western Washington University. Both authors have about ten years experience with this type of computing, one as head systems programmer and the other as a courseware author and instructor of teachers. Western Washington University has accumulated close to 5 million lines of code in instructional programs and over 5 million hours of student contact time with such programs. In addition, the authors have implemented a leading systems software package for classroom use on about ten varieties of microcomputer.

The need for an author language

We begin with the assumption that the computer can be an effective teaching tool in almost every subject area and at almost every level in the educational system. That is, the computer is not restricted to the mathematics program or to problem solving and laboratory simulation in science courses. Therefore we do not assume that the teacher has any computer expertise or any particular desire to acquire such, nor do we assume that the student responses to the computer will be primarily numeric. We further assume that it is easier to teach a teacher to program the computer than to teach a programmer how to teach.

An obvious question is, why is one of the prior choices necessary, why cannot the programmer write the teaching programs and the teacher use them in the classroom? This is the central question in this area, for if that division of labour is workable, then there is no need for specialized system software for this application. There are real [illegible] to the use of the computer in the [illegible] and the most serious obstacle [illegible] the computer in the classroom is teacher resistance. This is partially resistance to computers perceived as inhuman mechanical devices or in some cases [illegible] to perceived threats to job security, but in most cases it is a general resistance to educational innovation.

House, in a book titled *The Politics of Educational Innovation*, has given a useful analysis of the fate of the typical educational innovation (he used the introduction of computers into 2 year colleges as a case study). House concluded that the imposition of any externally developed innovation was bound to stimulate teacher resistance. No matter how forceful, powerful, eloquent or well funded the external advocates, their involvement is temporary, and when they move on teacher resistance dooms the innovation. The only way to achieve long-range acceptance and success of an innovation is to involve the teachers in the creation of the innovation. We find that these conclusions are especially valid for the case of computer use in the classroom: the best, and perhaps the only, way to overcome teacher resistance to computer use in the classroom is to involve the largest possible number of teachers in the creation, and in the editing and revision of courseware. This demands that we supply a language as systems software which will allow the teacher to make the computer carry out the desired task.

A number of languages for this purpose have been created; they are called author languages. Most teachers will refuse to use programs which force students to respond to the computer in an arbitrary format which is different from that used in other classroom activities: teachers want students to use standard notations or natural language. Every author language worthy of the label simplifies the processing of student responses to such a degree that processing natural language responses is simple. For example, let us consider processing the answer to a question which could be answered yes or no. If we allow natural language responses, we might get any of the following:

yes Yes YES Of course right sure

all of which we should recognize as meaning yes.

However, we also must recognize that the answers

It's yes or no I knew yesterday Surely not

do not mean yes, so a simple instring search is not sufficient.

When you begin writing code to accomplish that answer processing in a standard computational language like BASIC, you quickly understand a number of things. You know why instructional programs written in computational languages like BASIC usually fall into the "1 means yes and 0 means no — or the answer to every worthwhile question is a, b, c, d, or e — none of the above" syndrome. You also know why teachers who insist on natural language responses decide to "give up on the computer if that much effort is needed."*

In the author language which we advocate, COMMON PILOT, the task requires a single line:

```
M: yes%%!of course!sure%
```

Here **M** tells the computer to match the student answer, the exclamation point is an or operator to separate alternate equivalent responses, the % matches spaces or ends of answers, and space and case editing are automatic.

This simple example illustrates two of the needed features for answer processing: alternate answers, and case and space editing. In addition, we need provision for multiple answers, spelling errors, and extraction of numbers from text. All of these must be simple to program, and the resulting code must be efficient and intelligible. The answer processing instruction or instructions are the most important feature of an author language; they must be present, and their power is the best quick indicator of a particular author language's utility.

> *"The answer-processing instruction or instructions are the most important feature of an author language."*

Thus far we have argued for two points: computers will be used in classrooms when teachers can control and program them, and if we expect a wide variety of teachers to learn to program computers, we will have to provide a high level author language which will make the rather special type of programming a teacher might do as easy as possible.

Beyond having facility in handling natural-language responses, what else should a high level author language include?

Languages

We first discuss some further specific capabilities the language should have. Graphics instructions are essential; the utility of graphics in instruction is obvious.

The terminal screen should not always be used as an endless scroll; at a minimum, provision for line drawing, selective erasing, and free cursor movement must be included. The author language should include instructions for the full range of computations: floating point, scientific functions, and string functions. The numeric operations should be based on algebraic syntax. Most teachers have little interest in the elegance of alternative notations, nor are they willing to worry about the distinctions between integer and floating point variables. A typical subroutine structure including nesting is also needed. Subroutines and powerful computation can be combined to add features to the language not envisioned by the designers.

This is essential because we are still in the infancy of instructional applications, and our needs will grow. A trivial example may clarify this point: we know of no author language which will properly interpret the numerical answer 39,000, but it is easy to write a subroutine that will remove the troublesome comma.

Ideally the author language should free the teacher from onerous book-keeping details like memory allocation, variable type definition, and file management. Unfortunately, this is expensive in memory for systems software and for variable storage, so most author languages — COMMON PILOT included — *compromise on this point to keep hardware costs down.* The author language should allow the author to respond to the student who answers "four" when the expected answer was "4." In many versions of BASIC, when the current instruction is INPUT X, the response "four" so effectively locks up the system that the author has no way of telling the student what is wrong! Remember that the typical user of an instructional program knows nothing about computers beyond the effect of pressing the RETURN key. Therefore, coding error traps which halt execution to allow examination of variables, etc. are worse than useless. The proper procedure is to *flag* the error and *continue* on in the program. An inability to continue after coding errors is the most serious limitation of author languages implemented in other high level computational languages, although their efficiency and response time also leave much to be desired.

We turn now to some broader decisions in the design of author languages. The main differences between author languages are related to the decisions their designers have made in these areas. Instructional programs tend to be very long with very complex branching structures. We believe that this in itself means that the author language should be a disk based interpreter. Programs written in a disk based interpretive language can be as long as the disk allows — independent of memory size — and there are no limits on either branching distance or direction. This approach also allows the creation of instructions at run time, a feature which simplifies programming for randomly selected string parameters in questions and for graphics. Examples will be given in Part III.

A second far reaching decision is whether or not the language should be designed to ease the programming of a particular teaching strategy. For example, a very common strategy is a) ask a question, b) if answer is correct, go on to the next question, and c) if the answer is wrong, give a hint or comment and repeat the question. Implicit author languages make the branches automatically; that is, they include a correct answer matching instruction which also triggers the branch forward, and a wrong-answer matching instruction which also triggers the display and the branch backward.

We prefer explicit languages, in this example one that has only one matching instruction (used in both cases) and explicit branching instructions. Implicit languages use a single instruction to call forth a number of computer steps; explicit languages use a single instruction to call forth a single computer step. Because the number of combinations of single steps is much greater than the number of steps, an implicit language either has a very large number of different instructions, or its instruction set is incomplete. In practice it is always the latter case. There are certain missing combinations, usually the ones you need to write a simulation in a language designed for drill and practice. Also, most teachers find an explicit language easier to learn, and they find programs written in an explicit language easier to understand.

> *"Ideally the author language should free the teacher from onerous book-keeping details."*

Now that we have desirable features and characteristics for an author language, we must ask: is it practical? Is it possible to write an interpreter for a language which has these features and characteristics, which teachers can and will use, which leads to the production of quality instructional programs, and which runs on low cost hardware? The answer is a resounding yes. We believe that COMMON PILOT is such a language. We use COMMON PILOT for high-quality instructional programs. We have taught it to teachers from a variety of subject areas, and in the next instalment we will describe the hardware requirements for classroom systems using COMMON PILOT. ■

To be continued

---

* If a masochistic hacker is willing to invest the effort, he or she would find that the response time with the BASIC code is appalling.

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Series

WRITE IT YOURSELF

Dr Ince of the Faculty of Mathematics the Open University gives a simple introduction to the construction of assemblers For the first time anyone with a knowledge of assembly language can gain an insight into this fascinating subject

In this series of articles I intend looking at the topic of assembler languages and in particular how assemblers are constructed The articles will concentrate on microprocessor assemblers although the principles outlined are applicable to the whole computing spectrum from the largest mainframe to the humblest microprocessor The algorithms that I use to describe the construction of assemblers will be expressed in a PASCAL like syntax I make no apology for this Although a large number of readers of these articles will not have immediate access to a PASCAL compiler the language does provide a convenient and easily understandable way of expressing algorithms I hope that at the end of reading this series of articles you will have enough knowledge and confidence to construct your own assembler using *your* favourite programming language

A convenient starting point in a study of assembler construction is to examine the type of programming that is necessary when an assembler is *unavailable* Examine the following segment of Intel 8080 machine language that loads the B register with zero and transfers control to an instruction at hexadecimal address 0A

```
06 00
C3 0A 00
```

The first instruction consists of two bytes The first byte contains an operation code of 06 which means move the contents of the byte immediately next to this byte to register B The next byte contains zero, so that the effect of this instruction is to *clear* register B

The next instruction has an operation code of C3 which means transfer control to the instruction at the address contained in the NEXT two bytes ' These two bytes contain the address 0A, lower order byte first thus the effect of this instruction is to *jump* to the instruction at address 0A

This type of programming using either hexadecimal or some other numeric base is extremely inconvenient A programmer has to remember the numeric values of each operation available in the machine language and has to allocate and keep track of what each numeric address stands for This can be an extremely error prone process as a typical machine language might consist of about a hundred distinct operations and a typical program may contain a large number of addresses

Clearly programming would be a lot easier if alphabetic or alphanumeric identifiers are used to represent operations and addresses Thus the previous fragment of machine language would be better expressed as

```
MVI B,0
JMP NEXT
```

The first instruction contains a name which expresses the operation MoVe Immediate , the register (B) used and the value (0) to be placed in the register

The second instruction also contains a name which describes the operation JuMP followed by a *label* This label is attached to the instruction to which control is passed

The process whereby a program written in the above symbolic language known as an assembler language is *translated* into numeric language certainly looks simple it would involve keeping two tables

The first table which I shall call the **operation table** consists of a series of entries each of which consists of an operation name and its numeric equivalent

The second table which I shall call the **symbol table** consists of a series of entries each of which consists of a symbolic name and its equivalent numeric address

The translation process carried out by a program known as an assembler can be described by the algorithm

```
Read an assembler statement
while there are assembler statements to process do begin
    look up the operation in the operation table and replace it by its numeric equivalent,
    look up any symbolic names in the symbol table and replace them with their numeric addresses
    Output the machine language instruction that has been formed
    Read an assembler statement
    end
```

As you will see later this algorithm represents something of a simplification For instance it doesn t include any treatment of errors in the assembler program It does however embody the main principles that underlie the construction of any assembler Before I go into further detail it would be useful if I outlined what the main characteristics of assembler languages are

Characteristics

Field structure

The great majority of assembler instructions can be described by the format

label	operation	data or address	data or address

The format consists of

a label which can be optional

the operation to be carried out

a number of fields ranging from zero up to a maximum of normally two these fields usually contain numeric data or symbolic names

The fragment of Intel 8080 assembler code shown below contains instructions which fit into this format

```
        LDA     30H
        MVI     B,0
TEMP    RAL
        JMP     DIG
```

The above consists of two instructions (LDA and JMP) which contain one data or address field a labelled instruction (TEMP) which contains no data or address fields and an instruction (MVI) which contains two data or address fields

Label

A label allows the programmer to refer to an instruction usually by means of jump instructions A label is usually a symbolic name which holds the address of the instruction to which it is attached Labels are normally constructed from letters digits and a few other characters such as $ and * Thus control can be passed *to* the Intel 8080 instruction

```
TOP     MOV     B,A
```

by means of a jump instruction such as

```
        JMP     TOP
```

Operation

The operation field is the only part of an assembler instruction that is *not* optional It usually contains a name which is a shortened version of the operation to be carried out Some examples from the Intel 8080 assembler language are

JMP	JuMP
MVI	MoVe Immediate
INR	INcRement
JNZ	Jump on Non Zero

Address or data

These are fields which usually follow the operation They contain data or addresses which the operation acts upon Thus in the instruction

```
            MVI         D,30H
```

which places hexadecimal 30 into register D the first data or address field holds the *name of the register* the second data or address field contains the *value* that is to be *moved into* the register The address or data fields usually contain symbolic names, numbers expressed in octal decimal binary or hexadecimal form, characters sequences of characters or combinations of symbolic names and numbers Thus you may find the following in the address or data fields of Intel 8080 assembler instructions

00111111	**a binary pattern of two zeros followed by six ones**
0EH	**hexadecimal 0E**
22	**decimal 22**
17Q	**octal 17**
'F'	**the ASCII character F**
XY+2	**the address formed by adding 2 to the address of XY**

Pseudo operations

The operation field may also contain directions to the assembler These are called pseudo operations and are *not* translated into machine language They are usually used to allocate blocks of storage set up constants control the assembler listing, to define the starting point of the assembler program or to mark the physical end of the assembler program Examine the instruction

```
        DEVR        DS        100
```

This is an example of the use of the pseudo operation DS which is used in Intel 8080 assembler programs It allocates 100 bytes of storage starting at address DEVR

Comments

Comments form an important part of the documentation of any program This is true whatever language the program is written in The majority of assemblers allow you to write comments on the same line following an instruction The beginning of the comment is usually marked by a special character the semi colon being the character used with the Intel 8080 assembler e g

```
  MVI   C,17        END OF CONVERSATION
  JMP   TPZ   ,     TABLE SECTION
```

The majority of assemblers also allow you to write a comment on a whole line the comment being again signalled by a special character

Problems

Now that I have outlined the main features of an assembler language the next step is to describe the problems that one encounters in constructing an assembler The main problem is concerned with the processing of instructions that contain a symbolic name whose address is *unknown at that point* in the processing In order to illustrate this examine the fragment of assembler program shown

```
                    JMP      NEXC


       NEXC         INX      H
```

When the assembler is processing the jump instruction it is unable to replace NEXC by its numeric address This is because it hasn t processed the instruction to which the label is attached and therefore hasn t been able to associate the numeric address with this label yet

The problem does not only appear with jump instructions it also appears when an instruction references a symbolic name which has been defined by a pseudo operation that appears *later* in the program An example is shown below

```
                    LXI        D,BUFF



     BUFF         DB         0, 2, 3, 5, 8, 11, 13
```

where the LXI instruction references the first element of a table of values defined by the pseudo operation DB

A second problem that arises particularly with microprocessor assemblers, is that the conversion from a symbolic operation to its numeric value is unable to be carried out by simply looking up the operation in a table but also depends on the contents of other fields

> *"Principles outlined are applicable to the whole computing spectrum, from the largest mainframe to the humblest microprocessor."*

As an example consider the Intel 8080 MVI instruction It is converted into the value 1E when the destination of the move is the E register while it takes a value 06 when the destination is the B register Thus MVI E 7 would be assembled as 1E 07 while MVI B 7 would be assembled as 06 07 This problem can be dealt with fairly easily I shall leave its solution until a later article and concentrate on the first problem that of forward references

This problem can be resolved by adopting the simple approach of reading the assembler source program *twice* each act of reading the program being called a **pass**

I intend concentrating in the remaining articles of this series on describing the construction of two-pass assemblers The first pass consists of reading each instruction checking whether it contains a label or contains a pseudo operation which assigns a value to a symbolic name If it has found such an instruction then the symbolic name is entered in the symbol table along with its value

The second pass then uses the symbol table which has been built up in pass 1 Since all the values associated with symbolic names are now known, each statement can be re-read assembled and output as a machine language statement

Before I describe the algorithms for pass 1 and pass 2 I shall describe the tables that they use The **operation table** is usually made up of entries each of which contains the operation *symbol* the length of the instruction the value of the operation *code* and a number which represents the operation *class* The length of the instruction is needed in pass 1 in order to calculate the address at which each instruction is placed Thus if pass 1 has just processed an instruction at address 03, and that instruction has a length of 2 bytes then the next instruction is placed at address 05 The number which represents the instruction class usually describes the number of data or address fields that the instruction operates on

I can describe the **operation table** as

```
type optable entry = record
                          name      array (1  6)
                                          of char,
                          opcode    integer
                          length    integer
                          class     integer
                       end,
var opcodetable = array (1  100) of optable
entry,
```

I have assumed that the operation name is never more than six characters and that there are 100 separate instructions A simplified symbol table will consist of a series of entries each of which will contain the symbolic value and its associated address Most assemblers have more information in each entry Describing this information however would not help you in understanding the principles of assembler construction, and would perhaps confuse you with too much detail

I can describe the **symbol table** as.

```
type symbol entry = record
                          name      array (1 .8)
                                          of char
                          address   integer
                       end,
var symbol table = array (1  500) of symbol
entry
```

Again I have assumed that the symbolic name has no more than eight characters and that no more than 500 distinct symbolic names are used in any program

A third table is also necessary this is the **pseudo operation table** It need only contain the symbolic names of the various pseudo operations available in the assembler language It can be described as

```
type pseudo op entry = array (1  6) of char
var pseudo op table = array (1 ..10) of pseudo
op entry
```

I have assumed that pseudo operations contain no more than six characters and that there are only ten pseudo operations available in the assembler

These then are the data structures used in a typical assembler My next article will describe in more detail the algorithms for pass 1 and pass 2 which use these data structures to accomplish the assembly process ■

How to get on with microcomputers

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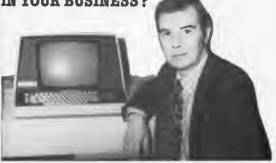
WHY NOT A COMPUTER IN YOUR BUSINESS?



In this the concluding article we examine what is involved in obtaining business software when a program package has proved to be unobtainable

I will assume that you have searched high and low for a software package to fit your application You have found nothing of any use because the software you have seen is

— of poor quality (a lot of what you will see at present falls into this category, sad to say!)

—too expensive (Very unlikely are you sure you are being realistic about what you need? A tailored solution is BOUND to be more expensive)

—inflexible (Quite possible though many packages can be tailored)

—not available! There will always be a shortage of good application software since it takes skill and time to develop good packages But make sure you have checked widely

Anyway you have examined available sources and have rejected ready-made packages What other course of action is open to you? You can

a Write a system yourself
b Involve a knowledgeable friend
c Commission software from a professional source such as a software house

Can you learn BASIC in two weeks?

Many microcomputers have been sold by salesmen taking the easy way out The method is

a Dress the electronics in an attractive cabinet
b Baffle the customer with impressive talk of RAM, ROM baud-rate and — most mysteriously — K (which is apparently something you can never have enough of)
c Steer well away from talking about the customer s application, or you may get into hot water
d Reassure the customer with talk of how he can pick up BASIC programming in 2 days
e Demonstrate the incredible speed with which the computer system retrieves telephone numbers on request (regardless of the fact you only put 25 numbers in the demonstration system, and ignoring the fact that the customer never expressed the slightest interest in storing telephone numbers)

Yes you can certainly learn to program in BASIC Yes you can learn to write a program in 2 days — well, one that ALMOST works With perseverance you may learn to create files of data on your floppy disks and (though less likely, read at least some of it back again But you are NOT a programmer, and you are certainly NOT a systems analyst

A simple' payroll program probably involves a minimum of 30 to 40 subprograms each performing a function in great detail — adding a new employee calculating National Insurance handling week 1 tax calculations, printing a P60 Even assuming sound knowledge and experience it may take a team of 3 or 4 professionals a year to produce even a basic payroll system Few beginners would tackle a payroll but many venture out on tasks nearly as difficult — a costing system preventative maintenance etc Learn BASIC by all means it will always come in useful but use it for adding small frills to existing systems not for creating masterpieces from scratch When a customer in my shop says casually that he is thinking of programming the whole system himself having glanced through the systems manual. I am always put in mind of Bristow in the Evening Standard studying "Brain Surgery for Beginners".

So, please avoid the facile suggestions of salesmen only interested in pushing hardware down you throat. Unless you really intend to dedicate a major part of your time to learning programming and systems analysis and have no deadlines in mind for the finished system, I strongly recommend you save your energies for *monitoring the efforts* of people.

Which brings us to

The knowledgeable friend

There are many capable computer professionals who are currently working on large mainframe computers. Such people can frequently be tempted into writing programs for other people's microcomputers. It gives them a chance to test out the little brutes without expending any money or taking any risks. Since such programs are not usually written for monetary gain (at least not primarily) you can frequently obtain a bargain. Needless to say, however, there are snags.

a For every competent programmer there are several less competent. Into which category does your friend fall? After all you may be on the point of entrusting the runing of a major part of your business to his abilites and judgement.

b A programmer writing programs as a favour in his spare time may write an excellent system because his interest is initially maintained by the desire to see the application running live in your company. However, he may well find the subsequent period of program *maintenance* considerably less engrossing and it may be neglected in consequence. Documenting the whole package may in fact prove so unappealing that he may never get round to it at all! Flushed by success he will wander airily on to pastures new, leaving you with a complex and over-ambitious program that (almost) works but only when he is around to answer the crop of questions which keep arising. Such a program will quickly die the death because it can only be maintained by its original author and tends to collapse like a house of cards if touched by someone unused to its peculiarites.

c Since you are probably asking a favour you may not be in a position to press for a firm time-table which can be adhered to. Nor have you any redress if the program fails to meet your expectations.

d Through no fault of his own his job may change forcing him to leave your system unfinished. He may have to leave the area. A 90% completed program is unfortunately of very little use to man or beast. Remember those hopeful sounding advertisements in the Used Car columns — restoration almost complete — requires very little work to make perfect runner — 2 bodies and 4 spare engines — £200 or try offer.

The remedies to the above are fairly obvious. A programmer friend can be a valuable asset or an expensive economy! Agree from the start that you will *pay* for the job — and at a reasonable rate. This may ensure you can insist gently on the job being finished and documented. Make sure you stay involved in the program so the he is obliged to explain its progress at regular intervals — otherwise he may get bogged-down with non-essential additions or deviate from the objectives as originally laid down.

What happens to a man with no friends?

Not everybody is lucky enough to possess friends with the necessary skill and time to help. How about a software house?

First of all this is bound to be the most expensive approach — but many people would say the best. Picking a software house is like picking a plumber: once you have found a good one, stick with him — or it. Many good software houses hardly advertise at all; their business comes through personal contacts and this is highly desirable. If you have not been recommended by an impartial third party it is only sensible to ask for a list of local firms who may be prepared to comment on work done for them. No reputable software house will refuse this request. If you do speak to past customers ask particularly about:

a deadlines. Was the work completed on time?

b price. Was the original quotation adhered to?

c accuracy. Did the program work as specified and were there bugs in the finished system?

d documentation. This should be comprehensive, well laid out and understandable by all levels of staff.

e business knowledge. Were the personnel competent businessmen or were they merely competent programmers?

Naturally you will ask for a quotation. You will probably receive an unpleasant shock when you see the price. It will certainly be much higher than you envisaged. However before rejecting it out-of-hand please remember that:

—good software ALWAYS takes twice as long as you estimate. The software house knows this from bitter experience and adjusts accordingly.

—software can seem expensive merely because the machine itself is now comparatively cheap. Manpower costs are increasing and skilled personnel are much in demand — commanding high salaries.

—the "you get what you pay for" rule applies in program writing just as anywhere else. If the quote is twice as much as you have been offered elsewhere, perhaps the other one is too cheap? Keep in mind that you are presumably considering a computer to save money. Therefore the application will pay for itself, but it cannot start doing this until it is installed and working live. Until that moment comes you are continuing to waste money.

Study the terms and conditions well. You cannot expect them to be slanted in your favour, but they must allow you redress. You may find yourself agreeing to pay at stages during the work. This is perfectly normal (after all, builders expect part payments as they complete foundations, walls and roof). You may well be asked to sign a document to say you agree to the specification being frozen. This is to guard the firm against your changing your mind when the system is half written. Again this is very understandable, but make sure you study the specification in great detail and ask all the questions you can at this stage. Nothing is worse than receiving the finished product after 6 months' work, and with considerable sums laid out, only for you to exclaim "Ah, we don't do it like that here, we need an extra column of percentage figures."

What may seem a simple change to you may mean a complete rewrite if the programmer never envisaged the requirement.

Finally, make sure the software house has experience of the system you are going to buy. If they have not, you will be paying for their learning curve and this may be expensive. If you find a firm that specialises in your machine you may even find that you do not have to buy the system until the program is complete, and this can considerably improve the cost justification — as well as minimising the risk involved since you can see the system working before you buy the hardware!

Cheer up!

It may be that I have overstressed the difficulties of buying a microcomputer in this short series of articles. But that is because I see the majority of buyers about to make the same mistakes over and over again. Reputable computer dealers build their businesses on reference sells. To sell a system that is not suitable for the application will not benefit the dealer or the customer. There are plenty of success stories around if you look for them. Delegate the computer purchase to a junior and you will almost certainly be disappointed. Involve yourself in planning the application, concentrate on a key issue in your company, and do not be diverted by hardware before you have solved the software issue. And good luck. ■

Bimonthly Series

THE MODULAR APPROACH

The second article on good programming techniques emphasises the value of program modules in keeping programming errors to a minimum.

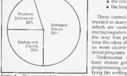


Figure 1 *The amount of time spent on the various tasks required to write a complete program from its original conception through to the final integration into the user system.*

In my first article, I described how only three basic control structures are required to write useful programs. I showed how any program can be written as a series of steps of the following types

- the sequence
- the condition
- the loop

These control structures can be implemented in many real computer languages which are currently in common use on microcomputers. It is now time to look at the way that programs are written and how the ideas already discussed can help us write clearer and more easily understood programs.

Professional programming managers have shown great interest in structured programming concepts as a way of simplifying the writing of programs and also in simplifying changes once they are in regular use. All large computer installations have large staffs of programmers, much of whose time is taken up maintaining the programs in regular use on their computer system. Not only do errors have to be fixed as soon as they are reported but programs have to be amended to take advantage of new facilities provided by new hardware or software and to take account of changes in operating requirements.

All programmers implicitly believe that there can be no bugs left in the final version of their program (it can indeed be argued that a bug does not exist — until it is discovered and reported), but as all Computer Managers know problems are soon discovered once programs are released for large-scale general use.

As microcomputer owners we are our own Computer Manager, programmer and user rolled into one. We have no specialist staff of systems analysts and programmers to rewrite programs to meet new conditions or revised operating requirements. We will have to sort it out ourselves. Most discussion of the advantages of Structured Programming is aimed at a professional audience and stresses the cost and staff savings which can be obtained by adopting these techniques. The object of this series of articles is to show that the *same* techniques can be used by microcomputer users to ease the chore of programming their systems. To make full use of them there is no need to purchase expensive software products.

As Figure 1 shows, three-quarters of the effort in writing a program goes into problem definition and design work *before* any code is written. What is being described is a methodology which can be used to write any program no matter which programming language is used. We are all busy people and do not want to waste precious time coding and debugging unnecessarily. By working methodically it is possible to write programs much more quickly than would otherwise be possible. Should the programs require amendment later, it should also be a much simpler task.

As a general rule any program goes through a number of clearly defined stages before becoming a useful working sytem. These stages can be defined as follows

a) **System Specification — defining what the program is intended to do**
b) **Program Design — the most difficult part, planning how the program can be written to meet the objectives defined in a)**
c) **Detailed Coding — actually writing the program code**
d) **Testing and Debugging — the most important part — ensuring that the program meets the original specification defined in a)**
e) **The program must be integrated into the system environment on your microcomputer so that it becomes usable**
f) **Documentation — telling yourself**

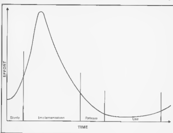


Figure 2 *A graph of the effort required to implement a program in the various stages of its life. The main sustained effort is the coding, debugging and testing of the code, but this is a very short period in the life of the program.*

and others how to use and maintain the program

As shown by figure 2 the main effort is concentrated in the implementation stages This is when the detailed design is completed and the coding and debugging are actually done Once testing is completed the amount of effort required drops rapidly to reach a minimum soon after the program has been cleared for general use Some maintenance effort is always required, but so long as the program has been specified and designed carefully this should initially be quite small. As time goes on requirements change, and changes become larger and more difficult until *it is often easier to design and write a completely new program* than to amend the current one If some attempt is made to predict possible future requirements in the specification and design stages, the maintenance effort can be minimised and the useful life of the program extended considerably

Let us now look at the way programs are normally changed to meet new requirements or to correct unexpected bugs By the time that the program requires amendment you will have forgotten much of the design work that you originally performed, so adequate documentation is essential This should be in the form of both a written User Manual and comments included within the program text It is an unfortunate fact of life that the only information that is always available with the program is that included within the program itself Comments should therefore be sufficiently informative for a new user to be able to run the program, at least in a simple fashion without any further instructions The effort required to amend the program can be divided into a number of stages.

- familiarizing — reading all the relevant documentation and program listing
- planning the changes required
- coding the changes and editing the program text
- debugging both the changes and the complete system
- integrating the program into the user environment
- amending and updating the documentation to include the changes made

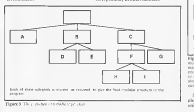
In any but the most trivial cases this is a not inconsiderable effort so any way of reducing it will be of interest The objectives of modular programming are to divide the program into *manageable* chunks This not only eases the problem of programming, but also limits the effect of a bug to the modules most involved

Once you start writing your own programs you will soon find that you can be completely familiar with only a very limited amount of code Once the program reaches a certain length you will not be able to undertand it completely

The exact number of lines required before this limit is reached is largely a matter of academic debate It is typically in the range of fifty to a hundred lines of code (one or two pages of listing) depending on the complexity of the problem and the programming language involved It is therefore advantageous if the program could be split into a series of *modules* each of which is short enough to be understood in depth Each module is in effect a mini program in its own right, and must be designed and written with the same care as a complete program Once written, each module can be tested independently of the others so that most bugs can be found and removed before they are assembled to form the final program The complete system can then be tested and any final wrinkles can be ironed out, particularly in the interface between different modules Since most bugs should have been eliminated before the program was assembled this should not take very long

How a modular program grows

Figure 3 shows how a modular program grows as more modules are defined Most modules appear only once within the structure of the program, but some, particularly low-level utilities may be used repeatedly in other modules



Each of these sub-goals is divided, as required, to give the final modular structure to the program

Figure 3 *The evolution of a modular program*

To function correctly, a module must have certain clearly defined properties

- *It* should be possible to enter it at only one point
- It should be left at only one exit point
- Any subsidiary modules called should return control to the calling module immediately after the point where they were invoked
- No module should call another module at the same or at a higher position in the calling chain that it is itself
- No module shall have access to any more data areas than is absolutely necessary for the performance of its designed function

These properties establish a *hierarchy* of modules in which each module is subservient to those modules which are higher in its command chain, and independent of those in other chains This ensures that, should a bug be deterted in the program, the span of its effect should be minimised as figure 4 shows

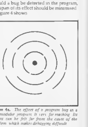


Figure 4a. *The effect of a program bug in a non modular program is very far reaching Its effects can be felt far from the cause of the problem which makes debugging difficult*

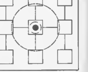


Figure 4b *The effects of a program bug in a modular program are much more limited being mainly felt in the module itself and to a lesser extent in the modules immediately connected to it Since the bug is immediately isolated it should be possible to find and correct it very quickly*

So long as the interface between modules has been designed in such a way that only data areas which are *actually* required by the module are made available, the effect of the bug can be limited to the module and the interface areas in surrounding modules. Those modules which are not directly connected to the faulty module should not be directly affected.

If no automatic facility is available, it is possible to trace the progress of the program by *printing a suitable message* whenever a module is entered or left. This is very useful at the early stages of module and program testing, since the dynamic flow of control through the section of interest can then be checked and debugged very easily.

Algorithmic Design

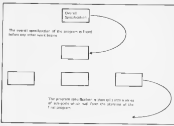
In most programming languages the modules can be written in the form of *procedures* and *functions*.

When possible, it is useful to declare variables local to a particular module within that module rather than globally when they are available unnecessarily throughout the whole program. Global variables are always dangerous since they can be changed in the most unexpected places, which may be very difficult to find, as the fault is only detected when the program uses that variable legally. The most common cause of bugs of this sort is the mis-spelling of variable names. Some relief from this problem can be had by using meaningful names and by using a language which requires that variables are declared before use.

Another area of variable usage which often causes problems is when *one* variable location is used to store a number of *different* items of information at different points in the program. Except for simple consistent cases, such as using the same variable whenever possible as a loop control variable, this should *not* be done. With the current increase in memory size on most microcomputer systems there should be enough space available for all the variables required by the program to be stored separately.

Even when using languages, such as BASIC, which severely restrict the number of variable names available for use, these are sufficient for any but the most complex programs, and these should be written in a more sophisticated language anyway. ■

Dr Martin Beer is at the Computer Laboratory, University of Liverpool



The overall specification of the program is fixed before any other work begins

The program specification is then split into a series of sub-goals which will form the skeleton of the final program

it's good to know we've got it right

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D P C Wishart (Mrs) (for Micro Centre)

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SAM

STATISTICAL ANALYSIS ON A MICRO

Statistics would be [illegible] just without computers [illegible] but the routine [illegible] necessary. In fact some [illegible] could be impossible without computers because the arithmetic required would take far too long by hand. It is not too much of an overstatement to say that the introduction of computers has made modern statistics both possible and important.

Micro computers can be seen as an extension of the process of using computers in statistics and as the start of a new era of statistical practice. When calculators became reasonably cheap, students were freed (subject to the various exam regulations) from the need to be good at arithmetic. Long equations could be worked out without the worry of making a few simple arithmetical errors. The more ambitious researcher could carry out simple calculations (means, standard deviations and even bivariate regression) without any help from other humans or computers proper. Calculators helped statistics and statisticians to avoid arithmetic, but did not help with the problem of managing and displaying data, nor with the need to carry out more advanced analyses easily and cheaply.

The value of a micro computer comes simply from its low cost! A large mainframe computer can do anything (and sometimes a little more) that a micro can do but usually at a higher cost. The paradox of the large computer is that it costs a lot to use but a lot of resources (investment and running costs) go to waste if it is not used. Thus there are some areas where the use of a large computer cannot be justified. If the need to work something out is infrequent, then buying a large computer or renting time and installing a terminal may not be economical. It's often said that a small statistical job is quicker by hand but this ignores the usual course of events that results in one quick hand analysis turning into a number of alternative hand analyses that would have been better treated on a computer. Large and long calculations often cost a lot of money if run on a large computer and, unless really necessary, are often not done. This wastes the effort spent in collecting the data through not getting all the information possible. Interactive analysis is also expensive in computer resources because of the repetitive nature of the operations. We have identified difficult areas where a computer approach is often ruled out:

> *"The value of a micro computer comes simply from its low cost!"*

1) **Small infrequent jobs**
2) **Very large jobs**
3) **Very interactive jobs**

Micro computers can help with all of these problems, although it must be admitted that it will always require a large computer for a very large problem. For the small infrequent jobs a micro computer can be bought for about the same price as a computer terminal (VDU + modem) and can be used as a computer terminal if the need arises. Once you've got your micro it doesn't cost you very much if you don't use it and no more if you do. Also a large range of software is available for most simple statistics. The very large jobs require a bit of patience because if they will run on a micro the processing times can be a bit long. However once you've bought your micro it's yours to use as much as you like.

The same reasoning holds for the highly interactive analysis. It doesn't matter how long you sit at your micro, it doesn't cost you any more. It should be obvious by now that the importance of owning a micro processor is just that — you own it and it's yours to use as and when you require at no extra cost. This in itself is enough to change statistical practice.

One area in which none of these considerations seem very important is in education. Most higher educational establishments have, or at least have access to, a large computer and, although they are usually charged for the use made, it's in allocation units rather than real money. However, using large computers to teach first year undergraduates, say, is wasteful in that it ties up resources that would be better used in larger problems. Again the micro computer can help by taking the load off the central computer, allowing students to make mistakes in complete freedom and acting as a local editing terminal for the more advanced problems.

Micro computers for statistics

The specification of a micro for statistics depends on which of the particular problems we have in mind. If we are mainly interested in small simple procedures with very little data management or in teaching, then a small tape-based system will suffice. For more ambitious analysis we must have a pair of (at least) floppy disks and the most powerful micro available for reasonable cost.

A brief suggested specification for the two types of application are (see fig. 1).

The largest cost difference between the two systems comes from the change from [illegible] Typical systems satisfying these specifications are PET and the small CBMs for smaller problems and the VECTOR MZ, NORTH STAR HORIZON, SORCERER or SWTP 6809 systems for larger problems.

Small Analysis and Teaching on a PET

For teaching and occasional small jobs the PET has a lot to offer: good graphics, a small self-contained unit and, above all, low cost. A good selection of simple stats programs are available for the PET, for example:

Mean, Median, Variance, Standard deviation, Skewness, Kurtosis, Histogram, Linear regression, T-tests, Correlation (CMB)

Paired T-tests, Unpaired T-tests, Linear regression, Mann Whitney, Wilcoxon, Spearman (CBM)

Curve fitting, Linear, exponential, log etc (PETSOFT)

Linear Regression (PETSOFT)

Moving average (PETSOFT)

T Tests, mean, standard deviation (PETSOFT)

Statistical distributions (PETSOFT)

Multiple Regression, Nth order regression (PETSOFT)

A typical PET data analysis session would involve the use of a set of program tapes — one tape for each statistical procedure required, and a few data tapes — one for each data set to be analysed. A data tape would be obtained either from a data collection program running on a PET connected to some measuring instrument, or by running a data editing/entry program. Making a data tape using an editing/entry program is easy. If the data consist of fixed length records of N variables then the PET simply prompts for each variable on each case in turn. After each case has been entered it is written onto tape and this tape is then used to "feed" the other stats programs. This all sounds trouble free, and it is, except for the slowness of reading and writing cassette tapes. This tends to limit the number of variables and cases which can be processed. In general interactive analysis is only possible for small data sets (50 cases and 10 variables say) although it really does depend on how long you are prepared to wait (if you are patient, then 200-300 cases can be processed). Another problem is that editing data tapes is really only possible if two cassette decks are available (reading the old data from one deck and writing the edited or transformed data to the other). The alternative is to read all the data into memory, edit it and then write it out again. This obviously limits the amount of data that can be handled.

Generally the PET makes a good small statistics machine. As a bonus it can also be used as an *intelligent terminal to a larger computer* — so instead of buying a VDU get a PET! It can be expanded by adding more memory (up to 32K) and dual floppy disks (about 300K) to make it a machine capable of large statistical problems. However, if you want a large statistics computer than it's probably better to go straight to a larger machine.

Large Statistical Problems

Even with all its extras the PET is not the best computer for large statistical problems — it runs only a BASIC interpreter and has too small an amount of disk storage. For speed of computation it's difficult to beat a Z80A (4 MHz CPU) running a compiled BASIC or FORTRAN (Microsoft) and a pair of MICROPOLIS quad density disks with over 1/2 Mega Byte of online storage. (Two machines which have these specifications are the SORCERER and the VECTOR MZ). For really large problems the computational power linked with a large amount of memory (up to 384K) of the SWTP CS09 (6809) system is useful. A range of disk drives with capacities of 175K, 2.5M and 16M means that a SWTP CS09 system can be tailored to the exact needs of the problem.

> *'Even with all its extras the PET is not the best computer for large statistical problems.'*

Using two floppy disks means that one can be used to hold a library of programs ready to be called from a main "driver" program and then the other used to hold data files. This speeds processing considerably because programs can be swapped in and out in a matter of seconds rather than minutes. The sort of problems that can be solved depends on how long you are prepared to wait — times such as 20 minutes for a 15 by 15 factor analysis are not uncommon.

For the larger statistics machines — SWTPC 6800/6809 or any S100/CPM system there is a conversational statistical package called SAM (Statistical Analysis for Micros) which makes interactive analysis particularly easy.

SAM

SAM is a collection of analysis programs written in BASIC. The currently available options are:

EDIT
Enter and change data, set missing values, enter and change correlation or distance matrices
TRANSFORMATIONS
Compute new variables, code variables, take a random sample
SUMMARY STATISTICS
Means, skewness, kurtosis, variance, standard deviation, range, median, percentiles
SCATTER PLOT
Interactive scatter plotting
TABULATION
Interactive cross tabulation, Chi squared, saving and editing tables.
BIVARIATE STATISTICS
Correlation matrix, means, standard deviations, partial correlation matrix, euclidian distances, saving any of the constructed matrices
T-TEST
Independent groups, paired groups, equal and unequal variance
ANOVA 1
One and Two way including F ratios
ANOVA 2
Up to 14 way crossed design.
CONVERSIONS
Rank, standardise and transpose a data file
REGRESSION
Simple bivariate, Multiple and Stepwise, compute residuals, Durbin Watson test
FACTOR ANALYSIS
Principle components followed by varimax rotation
DISCRIMINANT ANALYSIS
Multiple group, classification of sample
MAXIMUM RELIABILITY
CLUSTER ANALYSIS
Cluster analysis of variables
SINGLE LINK CLUSTER ANALYSIS
Cluster analysis of cases or varibles

In SAM each of the variables is referred to as V1 to VN, missing values may be defined and significance tests are usually given for most statistics. What is surprising about SAM is not the simple statistics available but the presence of the advanced multivariate analyses. Each of the programs uses data files in standard format prepared by the SAM editor. The complete set of editing commands is as follows:

PR	Print data
RS	Replace a single value
DV	Delete a variable
RR	Replace row
DR	Delete row
AR	Add a row
AV	Add a variable
SA	Save data in a file
MI	Set missing values
CA	Catalogue disk
KI	Kill (delete) a SAM file
EN	End edit

	Simple	Advanced
	Teaching	
Minimum user memory	8-16K	32-48K
Minimum backing store	One Cassette	Two disks 300-600K
Graphics	If possible	Not so important
CPU	Any	Z80A or 6809
Software	BASIC	CPM/FLEX BASIC FORTRAN
Hardware floating point	Not required	If possible
Cost	£500-1000	£2000-3000

Fig. 1

Other types of file such as correlation matrices and tables can be created and saved to be used later by other programs.

Perhaps the most important aspect of SAM is that it's conversational. A student can sit down in front of a VDU and after a few minutes of tuition on how to load a floppy disk into the machine and get started he can be analysing data and trying out methods. How many people can say that they have carried out a factor analysis while sitting at a VDU, looked at the results and reanalysed, and all in a few minutes? The real power of a system like SAM can only be gauged by actually using it but a sample SAM stats session is appended (see fig 2). (The approximate time for each operation is written on the right hand side of the print out.)

Statistics

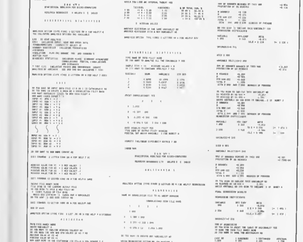

Fig 2

Conclusion

Small scale analyses and teaching can be carried out with a certain amount of patience on a small computer such as a PET. The biggest problem is the slowness of the cassette storage for data retrieval. Anyone contemplating using a PET is advised to compare the speed of floppy disks to that of a cassette first. For larger analysis or simply for more convenience a pair of floppy disks is essential. After adding such expensive extras it makes sense to use a more powerful computer to accompany them and to take advantage of the availability of the SAM package.

Micro computers have much to offer statisticians but it does require a certain amount of rethinking about how we practice and teach statistics. Statisticians no longer need to carry out calculations laboriously by hand and we can concentrate on understanding the purpose of our analyses rather than how to carry them out ■

References

Further reading SAM MANUAL — Research Resources Ltd 40 Stonehills Welwyn Garden City Herts England (07073 26633)

PETSOFT catalogue — Petsoft Redclyffe House 66-68 Hagley Road, Birmingham England (021 455 8585)

COMMODORE PET SOFTWARE catalogue — any Commodore dealer

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BRAND NEWs

Issue Three

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This middle section may either be pulled out or photocopied then filed for reference It will be comprehensive and range over the whole field of products services events and courses **PU** stands for Personal User **SB** stands for small base – that is small budget or small business **MB** – medium base medium budget or medium business **BB** – big base big budget or big business Addresses are to be found at the end of **Brand News.**

Systems

IMAGE DATA
Model 8 microcomputer Can use either 6802 (Motorola) or 8085 (Intel) microprocessors also capable of being co resident Modular design Memory in 4K and 8 Kbyte chunks CRT display Keyboard input Teletype input Dual floppy disc interface Cassette interface 2400 bits/sec and Kansas City 300 bits/sec Line printer output Max storage 40K RAM 24K ROM Software includes 8K BASIC assembler resident monitor diagnostics **OEMs, Labs** £500 £2500

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SEN ELECTRONICS
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MUTEK Ohio Scientific Model C2 4P computer Two versions C2 4P Mod 3 4 to 8K RAM cassette store and CS 4P Minidisk 16 24K RAM 1 or 2 minifloppies Expandable through user add ons Basic board is the model 502 cpu board 6502 micro disc bootstrap BASIC support machine code monitor in ROM 8K ROM 4 8K static memory ACIA interface Kansas City standard for tape 48 line bus Technical report and software available from vendor **PU SB**

COMPELEC
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TRANSAM
Triton Computer system Single board 8080A mpu 1K VDU RAM on board 8 levels of interrupt Tape Full alphanumerics TV or video display 56 station keyboard Up to 3K user RAM on board 64 graphics characters Audio (standard TTL) outputs Power supply Expansion boards System utilities *PU Labs Schools*

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BRAND NEWs

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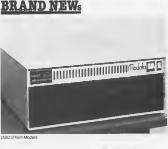

DSC 2 from Modata

Applications

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BARONESS INTERNATIONAL
PRESS package for PR Advertising and Communications business Vendor is a public relations firm handling Commodore PET Abacus Package comprises 1) Activity planner Daily check up client by client pending matters according to client date type of activity end of month summary printed sent to clients as activity report 2) Mailing system By categories permits up to 300 names & addresses on one floppy disc up to 100 categories System also handles accounting tasks including clients costing accounts Two versions of system available (PET dual mini floppy tractor feed or DAISY WHEEL printer) **SB**

KEEN COMPUTERS
Estate Agents property sales and enquiry system With operations manual Routines to enter details of new properties amend/update enter potential purchaser details sales checklists house sale negotiation analysis routine letters transfers records to archives delete prints or displays any record access property records on upto 8 enquirer specifications Vendor claims the system can handle an unlimited number of records Three configurations available (APPLE 11)

MICROTEC
Accounting system Self contained package but can interface with vendor's Stock Control System and Client Information System Range of information includes sales day book purchase day book sales ledger statements customer statements aged creditor listing aged debtors listing Client Information System contains over 1000 records names & addresses usable as mailing list name search capability Stock Control System online creates maintains analyses stock information Maximum capacity 5900 records **SB** (NORTH STAR HORIZON)

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[illegible]

Printers

TANDY
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ANADEX
New improved version of model DP 8000 now incorporates movable paper feed sprockets for wide variety of paper sizes self test facility provides diagnostics on main functions 1K buffer standard with 2K option **SB**

DATAPRODUCTS
Model M 200 MATRIX printer Unique MATRIX head design vendor claims 340 cps bidirectional logic seeking Throughput 125 lpm at 132 chs per line 200 lpm at 72 chs per line 300 lpm at 40 chs per line Paper slew speed 10 ips Single line advance 50 ms Interface 8 bit parallel standard RS232/current loop optional Character font 7 by 7 Character set 128 (96 ASCII 32 internationally used) 132 cols 6 lines per inch (standard) 6 8 lines per inch (optional) Character spacing 10 & 5 cpi (standard) 16 7 (optional) Forms continuous fanfold Diagnostic display integral with printer **MB OEMs**

DATA DYNAMICS
ZIP 30 Keyboard printer Employs standard Teletype 33 paper 5 by 7 dot MATRIX 96 characters ASCII 10 4 chs per inch 80 chs per line 6 lines per inch 10 or 30 cps switch select Friction drive Transmission 8-bits serial plus one or two stop bits Interface 20mA half or full duplex current loop V24 CCITT (RS232C) telegraph option Two versions ASR KSR QWERTY or AZERTY (continental) keybds **PU SB, OEMs, Labs.**

The new improved Anadex DP 8000 80 column printer with adjustable width sprockets as used for label printing

Press launch of new Anadex DP9500 printer at [illegible]

EPSON
TX 80 DOT MATRIX printer serial impact 70 lines per minute Unidirectional 80 columns 5 by 7 DOT MATRIX for characters 6 by 7 DOT MATRIX for graphic patterns Column spacing 1 10 Line spacing 1/6 Paper tractor or friction fed P ROM version allows change of the control or character generator at customer's site Interface logic 8 bits parallel TTL level buffer 1 line (80 chs) data input rate 1000 cps max Paper roll feed or friction type Optional interface boards for PET TRS 80 APPLE 11 serial available **PU SB OEMs**

PENNY AND GILES DATA RECORDERS
Lear Siegler 200A Series BALLISTIC printer Manufacturer claims revolutionary printing principle Speed 180 cps bidirectional MATRIX 9 high 7 wide permits upper lower case underlining Columns 136 Character format 136 chs per line 10 chs per inch 6 or 8 lines per inch vertical optional 16 5 chs per inch Character set standard 96 ASCII other sets available Carriage return time less than 350 ms for 13 6 inches Tab speed up to 45 inches per se[illegible] Forms handling page feed mechanism adjustable handles standard business [illegible] vertical and horizontal formatting Operator controls and indicators Serial interface EIA RS232C CCITT 300-9600 baud half or full duplex 20mA current loop option **MB BB OEMs**

Pr[illegible]

Bureaus, Consultancies, Services, Shops

AUERBACH
Data World publication [illegible] main frame analyses evaluates [illegible] systems Vol 1 general purpose computers Vol 2 minicomputers Vol 3 peripherals data handling and software Vol 4 data communications Regularly updated telephone/telex advisory service **SB**

AUTOPAY
New concept in payroll management Bureau buys block of time on IBM mainframe repackages into smaller units can offer time to even the smallest company Allows audit trail amendments net pay payslips master copy payroll employee record/deduction cards all tax social security forms Payment facilities are cash cheque credit transfer **SB, MS** (IBM)

DATA EFFICIENCY
Britain s leading accessory manufacturer claims vendor VDU TROLLEY Designed for secretary s desk or as a mobile work station Price £108 24 **MS SB**

The Data Efficiency Trolley now available

DATALEASE
Consultancy analyses small businesses writes packages to suit Currently using APPLE 2020 (ITT) but not tied to any one system 2020 software leases to small business

F INTERNATIONAL
Starter Plan Fixed price consultancy advice for first time business users Offered at £850 plus VAT Aimed at those likely to get equipment in £10000 to £15000 range would like advice at reasonable cost **SB**

FURNESS COMPUTER SERVICES
Deals with APPLE 11 plus Centurion 11A disc system (APPLE interface) all APPLE attachments APPLE software Offers printer Lear Siegler Diablo Hyterm Anadex Centronics (APPLE **SB**

BRAND NEWs

LIFEBOAT ASSOCIATES
Software from Digital Research [illegible] Edos file management and KBASIC Microsoft BASIC with file management Micropro CBASIC 11 Applications software from GRAFFCOM (payroll sales accounting purchases) (NORTH STAR HORIZON VECTOR MZ OHIO SCIENTIFIC CROM EMCO RAIR BLACK BOX DYNABYTE SD SYSTEMS RESEARCH MACHINES EXIDY SORCERER HEATH IBM 8 Format discs **SB**

MASTIFF SECURITY SYSTEMS
Hands free electronic security system Uses miniature radio code transmitting tokens that automatically release an otherwise permanently door lock for authorised personnel

Can similarly be used to activate automatic door opening mechanisms Even when the door is open alarm facilities of system detects non token bearing entrants Token kept in pocket or clipped to clothing **MB BB**

SUMLOCK BONDAIN
Deals with same range as Furness Computer Services (see above) **SB**

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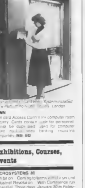
ENGLAND
Phone 0727 52801
Telex 925 859

MICROCOMPUTER CONSULTANCY & BOOK SELLERS



Access [illegible] Card Entry System installed at the Performing [illegible] Society, London

TANN
Tann card Access Control for computer room security Cards contain code for personnel cannot be duplicated used for computer suites nuclear sites banking insurance companies **MB BB**

Exhibitions, Courses, Events

MICROSYSTEMS 80
Exhibition Coming to terms with the second Industrial Revolution With Conference run in parallel Three days *January 30 to February 1 1980* Space enquiries to Iliffe Promotions Dorset House Stamford Street London SE1 Tel 01 261 8437/8

INFO 80 EXHIBITION
VENUE Cunard International Hotel DATE 12th 18th Feb

IMEC
(Information Management Exhibition and Conference) VENUE Wembley Conference Centre DATE 18th 21st Feb

COMPUTERMARKET '80
Three regional venues 1) VENUE Albany Hotel Birmingham DATE 4 5 6 March 2) VENUE The New Century Hall Manchester DATE 11 13 March 3) VENUE The Albany Hotel Glasgow DATE 18 20 March Details from Couchmead Ltd 43 Great Windmill St London Tel 01 437 4187

Modata
30 ST JOHNS ROAD
TUNBRIDGE WELLS
KENT
Telephone Tunbridge Wells (0892) [illegible]

DIGITAL MICROSYSTEMS
LOW COST BUSINESS COMPUTERS

DSC 2
- ONE to 30 MEGABYTES DISK STORAGE
- 64 Kbytes of Main Memory STANDARD
- Digital Research CP/M operating system STANDARD
- TEXT PROCESSING BASIC COBOL FORTRAN available

HEX 29
- 32 to 96 MEGABYTES DISK STORAGE
- 30 USER & 16 TASK capability STANDARD
- Relocatable ASSEMBLER & BASIC STANDARD
- Floppy disk based development system [illegible]

MODATA [illegible] parts of U K and IRELAND

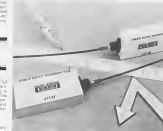
BRAND NEWs

MICRO MEET
One day conference on microprocessors Organised by Industrial and Commercial Finance Corporation (ICFC) together with Association of Independent Businesses (AIB) For those considering introduction of the technology into their businesses Contact AIB General Secretary Brendan Donnellan at World Trade Centre London E1 9AA *Tel 01 481 4669* VENUE Royal Garden Hotel Kensington London DATE 6th Feb

VDUs, Graphics Terminals & Systems

BORER ELECTRONICS
1 MODEM Model 96LSi 9600 bit/s full back speed 4800 bits/s or multi channel facility Line switching for dial up diagnostics 2) MODEM C rcuit card MODEL 75 1200L Two speed specially for VIEWDATA Central computer sites 75 bit/s receive 1200 bits/s send receive and send isolated from each other **MB, *Engineers***

BURR BROWN
FIBRE OPTIC data link EVALUATION kits Models FODL K1 FODL K2 FODL K1 employs transmitter (3712T) receiver (3712R) fibre optic cable (920ft long) with factory installed connectors Data transmission 25K band FODL K2 employs 3713 transmitter 3713R receiver 6ft long termination cable communication at 250K band Models in 42 x 77 x 17mm metal package for noise immunity Datalinks noise free For engineers FODL K1 at £68 35 FODL K2 at £66 25 Ex stock **SB MB OEMs**

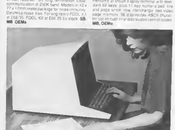


Fibre Optic data link

CPU PERIPHERALS
Pentland VI Visual display terminal with standard 62 keys plus 11 key numeric pad line and page scroll row interchange two video page memory 96 displayable ASCII character set and optional displayable control codes **MB, OEMs**

DATA DYNAMICS
Two new VDUs Models DD 912 and DD 920 Both models have a full alpha numeric keyboard integral numeric keypad identical except DD 920 incorporates row of eleven function & editing keys Can be operated in conversational or block transmission mode

Each has a 12 non-glare screen up to 1920 characters 24 lines of 80 characters Full upper and lower ASCII 7 x 10 dot MATRIX format 12 x 10 resolution Standard addressable and manual cursor control data protect underlining block transmission Tabs can be set cleared either from keyboard or from line Data editing facilities DD 920 has eight separate editing function keys including line insert/delete clear to nulls or spaces clear to end of line clear to end of screen clear full intensity data only Interface CCITT (RS232C) or 20mA current loop Transmission rate from 75 to 19200 baud Full duplex or half duplex 10 or 11 bit word communication operator selectable Parity either odd even mark or space (switch selectable) Keyboard 81 keys (DD 912) or 105 keys (DD 920) including alpha lock 14 key numeric pad **MB BB OEMs**



Pentland VI

HI TECH ELECTRONICS

New full colour vdu board compatible with IEEE S100 system computers Without the need for special monitors plug in board outputs range of grey scales colours for both alphanumerics and graphics stand alone or compatible with Prestel and Teletext Separate background and foreground colours flashing and double height are standard optional sync inputs allow for PAL video caption generation One off end user price of £295 includes [illegible] giving full [illegible] control [illegible] mode which can be booted [illegible] based systems Spec High definition [illegible] interlaced 625 PAL colours 15 [illegible] vendor states actually 20 different colours available 24 lines by 40 characters single or double height Two page memory [illegible] number of character options Programmable port Memory mapped to an 2K boundary Full documentation plus [illegible] Full IEEE specification **PU SB MB OEMs**

NEWBURY LABS
Models 7000 & 7000C Smart microbased Visual Display Terminals Teletype Compatible 24 lines of 80 characters per line Selectable baud rates from 50 to 19200 baud CCITT V24 or current loop interface selectable half or full duplex 12 Green phosphor display Character Set 64 ASCII/ISO Character Format 7 x 5 Dot MATRIX 50 times per second refresh rate RAM Memory Model 7000C as 7000 plus XY Cursor address Page mode facility **SB MB OEMs**

KGM ELECTRONICS GROUP
New range of video display modules Consisting of CRT together with all necessary

drive electronics mounted in a lightweight sturdy chassis the units are designed for integration into a computer system or stand alone cabinet They are available in direct drive or composite video input versions with dynamic focussing in both planes and EHT circuits to conform to proposed EEC safety regulations **MB OEMs**

PRENTICE CORPORATION

MODEL SLD Alternative to MODEMS applicable for *short haul* networks SLD Modular synchronous Line drivers more properly a synchronous short-haul modem uses phase — encoded or delay modulation technique High speed Operation 4 wire full duplex or four wire half duplex Complete self diagnostics include local & remote loopback and self test SLD transformer coupled to and from V! line does not require dc continuity over line Distance SLD transmits dependent on Transmission rate size of cable wire **MB OEMs.**

RACAL

Industry s first V22 modem Model No 1222 1200 bits/sec full duplex 2 wire modem complies fully with CC1TT V22 spec incorporates diagnostic test facilities automatic recognition at 1200 bit sec 600 bit/sec synchronous or asynchronous up to 300 bit/sec asynchronous Manual switch selection of data rate possible Ideal for time sharing bureaux **MB BB**

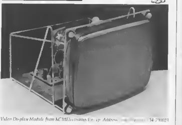
TEKTRONIX

Models 4052 and 4054 Two new models to complement the "very successful" 4051 Desktop Graphics Computing System Offer greatly increased speed in processing and data communictions As in the 4051 new products incorporate Tektronix flicker-free storage screens internal magnetic tape drive (300 Kbytes for data and program storage) IEEE-488 general purpose interface bus, but both use new Tektronix designed 16 bit bipolar bit-slice processor giving greatly increased system speeds Can also generate dense displays of mixed graphics and alphanumerics faster than before Processing speeds, on average ten times faster than on the 4051 and up to forty times faster depending on program content New instructions added to facilitate fast accurate 14-digit floating point arithmetic. Rates up to 9600 baud Memory capacity in the 4052 and 4054 increased to a standard 32 kilobytes, expandable to 64 kilobytes 4052 has the same 11-inch screen as 4051 same constant-time vector generator 4054 has 19-inch CRT constant rate generator, allowing it to draw short vectors faster Vendor states ' significantly increasing drawing speeds " High resolution 19-inch screen allows up to 13 million resolvable points, accommodates 133 lines of text. The 4054 provides vector character generator instead of the more usual dot MATRIX method Four user-selectable character sizes provided facilities for drawing dotted, dashed and solid vectors The 4050 series of products fully compatible in language software storage and GP1B peripheral devices MB BB Technologists

TEKTRONIX

Model 4663 FLATBED PLOTTER Drawings up to A2 size Joystick digitising for data entry roll-paper feed for multiple plots, different colours and line thicknesses, plots upto 22 inches per second Interactive Full range of software and graphics to make complete work station MB BB, industry

BRAND NEWs



Video Display Module from KCMElectronics Group Address [illegible] 34 790023

Newsflash

THE TIMES BUSINESS WOMAN OF THE YEAR 1979

Mrs Stephanie Shirley Chairman and Founder F International Limited has been chosen as runner up to The Times Business Woman of the Year 1979

Better known as Steve Shirley she founded the company — which is a computer systems house providing consultancy business and scientific analysis systems design and programming — in 1962 prior to the birth of her son Giles

Over the last 17 years F International has grown considerably and now has a panel of 600 highly skilled data processing practitioners most of whom work between 20-25 hours per week from home with visits made to clients premises as required

F International Limited also has several men on its panel as well as a few disabled people who are unable to work in a conventional office mode The company s headquarters remain at The Bury in Chesham but the main work force of the company is decentralised and operates within four regions countrywide

Not content with originating a highly successful business in the UK Steve Shirley has now formed two subsidiary companies in Copenhagen and Amsterdam organised similarly An American company with branches on the east and west coasts operates under a licence agreement with F International supplying the initial guidelines and expertise

F International provides consultancy analysis programming and relevant management advice to a regular clientele of central and local government (Steve Shirley s own particular interest area) leading banks Insurance companies financial institutions and other blue chip organisations

F International s one single asset is its people Managers technologists and back up personnel who have made the company the success it is and Steve Shirley shows her appreciation of the hard work provided by panel members in order to retain the success of the company by way of productivity bonus schemes and a presentation of an award for 10 years service within the company — a prize attained by many emphasising the stability of the company and satisfaction of panel members

Today Steve Shirley is a Vice President of the British Computer Society which she joined as a student member when it was founded Member of The Computers Systems and Electronics Requirement Board which advises The Department of Industry and Chairman of its Computer Committee and also Editorial Advisor on EDP to the publishers J Wiley & Son

Steve Shirley (aged 47) and her husband Derek have recently celebrated their 20th wedding anniversary in their home which used to be a Schoolhouse built in typical Buckinghamshire brick and flint

Editor's note Isn t it time women in computing were given a lot more recognition?

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DOING IT IN BINARY

Continuing the series for the absolute beginner.

Binary addition is very similar to decimal addition or for that matter to addition in any other system. However one must bear in mind the basic rules for addition which in the decimal system are followed without any thought. So let us review these rules in order to emulate them in the binary system: we start from the Units position, we add the two least significant digits (LSD's) together to get a number between 0 and 18. If this number is between 0 and 9 (i.e. the base 10 minus 1) we write it down and proceed to the next position (the 'tens') and so on. If however the sum happens to lie between 10 and 18 (1 9) we write down the LSD of the sum and 'carry' a '1' to the next position. This carry is added to the sum of the two digits in the next position and the procedure continues.

This procedure could be summarized as:

1) **Add the LSD's of each number to obtain a sum digit and a carry digit.**
2) **Record the sum digit**
3) **Add to the next rightmost digits of each number with the carry obtained from the previous step to obtain further sum digit and carry digit.**
4) **Repeat steps 2 and 3 until you do the MSD's**
5) **Record the last carry**

Binary addition

Binary addition follows exactly the same procedure as above. But bearing in mind that the binary system has only two digits (0 and 1) the sum would be either 0 or 1. As in the decimal system, in the binary system there is also an addition table to be reckoned with. If the two bits to be added are a_n and b_n and the carry from the previous stage is c_{n-1}, the sum bit s_n, and the carry bit to the next stage c_n, would be summarised in Table 1.

a_n	b_n	c_{n-1}	s_n	c_n
0	0	0	0	0
0	1	0	1	0
1	0	0	1	0
1	1	0	0	1
0	0	1	1	0
0	1	1	0	1
1	0	1	0	1
1	1	1	1	1

TABLE 1

Example: to add A = 101001 and B = 100111

C	**011110**
A	**101001**
B	**100111**
S	**1010000**

Octal and Hex addition

The procedure for performing octal and hexadecimal addition is similar to that used for decimal and binary addition. The fact to keep in mind in the octal addition is that the octal system has 8 digits (0 through 7) and a carry occurs when the sum exceeds 7. In the hexadecimal addition the carry occurs when the sum exceeds F (15_{10}).

Examples:

(1) A = 3217_8, B = 4363_8

```
0110
3217
4363
7602
```

Thus A+B = 7602_8

2) A = $89A5_h$ B = 5776_h

```
110 0
89A 5
577 6
E11 B
```

Thus A+B = $E11B_h$

Negative numbers

Numbers are stored in the computer in a fixed length format. The format could be 8, 16, 32 etc bits depending on the computer architecture. In the course of this article we shall give examples of representation and arithmetic operations for numbers eight bits wide but the methods illustrated could be very easily expanded to any number of bits.

With eight bits it is possible to count from 0 to $2^8 - 1 = 255$. Thus it is possible to represent 256 different numbers. If we wish these numbers could be interpreted as positive integers and hence the range of integers that could be represented is 0 to 255 inclusive. However if we wish to store negative numbers in the computer then it is possible to assign one bit, the MSB, to indicate the sign of the number. Thus if the MSB is, say, a 0 then the number is positive (or a zero) or if the MSB is a 1 then the number is negative. This method is called sign magnitude and it is similar to the method we use in representing decimal numbers; it has the advantage of being easily recognisable: the MSB represents the sign and the rest of the number represents the magnitude. However this method suffers from a major drawback when trying to perform arithmetic operations on numbers represented in this method: before carrying out the operation (addition, subtraction) we, or the computer, must check the signs and magnitudes of both numbers in order to determine the nature of the operation and the sign of the result. As an example adding a positive number to a negative number requires comparing both the signs and magnitudes of both numbers subtracting the smaller in magnitude from the larger then copying the sign of the larger and this for the computer is not the most efficient way of operation

Two more efficient methods are available for representing positive and negative numbers They are called 1 s complement and 2 s complement representations We shall illustrate the latter only, as it is the more frequently used

In the 2 s complement method positive numbers (0 to 127) are represented in a way such that the most significant bit is a 0 and the other bits represent the number e g 00010100 = $+20_{10}$ and 01000000_2 = $+64_{10}$

Negative numbers are represented as 2^8 N or 256 minus the absolute value of the number Thus -20_{10} will be represented as 256 20 = 236_{10} = 11101100_2 Notice that negative numbers will always have their MSB equal to 1

It could be easily proved that this method is consistent that is if we add two numbers, regardless of their signs, the outcome is a number represented in this method One thing the user of this method must be careful with and that is that the sum should not exceed the range of the storage element: 0 127 for positive numbers and 1 to -128 for negative numbers in which case the outcome will be in error

Examples (1) $A = +20_{10} = 00010100_2$
$B = -4_{10} = 256 - 4 = 252 = 11111100_2$

00010100
11111100
(1) 00010000

After discarding the overflow the result is

$00010000_2 = 16_{10}$

(2) $A = -20_{10} = 11101100_2$
$B = +4_{10} = 00000100_2$
$A+B = 11110000_2 = 240_{10}$ 256-16 16_{10}

(3) $A = -20_{10} = 11101100_2$
$B = -4_{10} = 11111100_2$
$A-B = 11101000_2 = 232_{10}$ - 256 - 24 - 24_{10}

In general if we are using an n-bit format, the range of positive numbers is 0 to 2^{n-1} 1 and the range of negative numbers is -1 to 2^{n-1} A negative number N will be represented as 2^n-N

It is worth mentioning at this stage that in most computers there is a "carry flag which indicates, at the termination of the addition if the capacity of the storage element has been exceeded and then, on testing the status of the carry flag the program can take action to amend an error which might have occurred due to the fact that the sum is no longer correct

Finding the 2's Complement

There are two easier methods for finding the 2 s complement representation of a negative number The first is by writing down the absolute value of the number in binary form then complementing each bit (0→1 and 1→0) then adding 1 to the new number Example 20_{10}

$20_{10} = 00010100_2$
after complementing 11101011
+1 = 11101100

The second method is by scanning the absolute binary form from right to left copying all 0's (if any) and the first 1 then complementing all other bits Example - 22

$22_{10} = 00010110_2$
$-22_{10} = 11101010_2$

There are two points worth mentioning at this stage

The first is that after two successive complemenations of the binary number the result is the original number and the second is that in negative numbers, leading 1's are equivalent to leading 0 s in positive numbers they are used as "Fillers"

Subtraction

Using 2's complement representation subtraction becomes very easy complement the number to be subtracted and then add the two numbers together The result will be the difference in 2 s complement form ■

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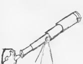
LEARNING FORTH

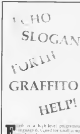


Continuing the series on th [illegible] H. Moore

Series

The third article in the series on a language for micros

Variables



Forth is a high level programming language designed for small computers. It has been in existence for some years and has a following in America but is only just beginning to appear in Britain. The main advantages of FORTH are

* It requires only a *small* amount of memory
* It is *fast*
* It lends itself *naturally* to structured programming
* It is virtually *machine independent*

I propose to illustrate the use of FORTH by showing a program and what it does, then discussing how it does it. The implementation I am using is APPLEFORTH V1.5 on cassette. I also have APPLEFORTH V1.2 by Programma International, though I have not made much use of this version yet. Both these versions are also available on disk.

We now show how to assign addresses in the dictionary at which the values of variables may be stored and accessed.

The form is

0 VARIABLE X

When this is entered from the keyboard an address labelled X is created and value 0 is stored there. (Two consecutive addresses are used in fact, so that a sixteen bit number may be stored.) To change the value to 6 say, during the course of a definition or immediately, we write

6 X ! (**! is FORTH for "store"**)

The value 6 has now been stored at the address X, replacing the value 0. In FORTH, clear distinction is maintained between the *address* of a variable and the *value* stored there. Thus if you type

X

the address is printed and not the value.

To see the value of the variable X you type

X@ .

The FORTH word @ (pronounced "at") is used to fetch the value to the top of the stack. 6 would be printed in the present case.

You may add a number to the contents of X without fetching the value by means of the FORTH word +! e.g.

10 X +!

adds 10 to the quantity stored at X. This statement is equivalent to the BASIC statement

X = X + 10

This latter form, I am sure, must create difficulties with school children who are learning at the same time to handle algebraic equations. They may get to know what it means but they will take some time to *feel* what it means. Luckily in BASIC you are not allowed to use *numbers* as the names of variables, for then the form

6 = 6 + 10

would be allowed, although it is no more ridiculous than

X = X + 10

In FORTH you *could* write

6 VARIABLE 5

which simply means that at the address labelled 5 the number 6 is stored. To save confusion in reading, however, this is best avoided, although the machine would not be confused!

Suppose variables X and Y have been assigned, then we might write

X @ Y +!

for adding the contents of X to that of Y. This can be written as above for immediate execution or compiled into a definition

```
: XINTOY X @ Y +! ;
: YINTOX Y @ X +! ;
```

(The contents of X in the first definition and the contents of Y in the second are left unaltered.)

Here is a time comparison with BASIC (Applesoft), see fig. 1.

What is the result of

```
 : XSHOW      X @ . ;
   YSHOW      Y @ . ;
 SEQUENCE   0 X ! 1 Y ! 10 0 DO
XINTOY YSHOW YINTOX XSHOW LOOP ;
```

You guessed it! Twenty terms of a Fibonacci sequence.

In BASIC the equivalent is

```
10 X = 0 : Y = 1
20 FOR I = 1 to 10
```

FORTH

```
: TEST 10000 0 DO XINTOY LOOP ;

 RUN TIME = 6.2 Sec
```

BASIC

```
10 FOR I = 0 TO 10000
20 Y = Y + X
30 NEXT
RUN TIME = 31 Sec
```

Fig 1

```
30  X   X + Y    PRINT X
40  Y   Y + X    PRINT Y
50  NEXT
```

Constants

To define a *Constant* such as the acceleration due to gravity we may use

```
981 CONSTANT G
```

G here stands for the value 981 so that

```
G .
```

prints 981 and not an address. The rules for naming variable addresses and for constants are the same as for defined words. The first three letters (symbols) and the length of the name are recognised.

Arraya

There is no real distinction between arrays and variables but obviously, for convenience, a method is needed for setting aside enough space in the dictionary for the number of elements you require. This is done by means of the FORTH word ALLOT. If, for any purpose, you wish to reserve an area of memory in the dictionary which will not be written into unless you specify it, you may write for example

```
200 ALLOT
```

and the next 200 1 byte locations (room for 100 2 byte numbers) are reserved. This word is not used only for arrays but also for, say, protecting the high resolution graphics page from being written into. To get at the reserved area for assigning array elements we first specify the base address by

```
          0 VARIABLE X
and then  200 ALLOT
```

Now

```
X @
```

fetches the contents of the base address and,

```
X 2 + @
```

fetches the next.

To systematise this we now define array handling words

```
: BIN DUP + + ;
: GET BIN @ ;
: SHOW GET . ;
: PUT BIN ! ;
```

X 3 BIN is the address of the third array element.

X 3 GET fetches the value from the third address.

X 3 SHOW prints it.

25 X 3 PUT says in English "put 25 in the third address of the array X".

X 6 GET X 7 GET + X 6 PUT
adds the contents of X 6 and X 7 and stores the result in X 6.

With the words as we have defined them

X 6 corresponds to X(6) in BASIC.

If we want to store the natural numbers in consecutive array "bins" we may write

```
1 X 1 PUT 2 X 2 PUT (etc)
```

or better

```
NATNUM 0 do 1 X 1 PUT LOOP
```

Now 100 NATNUM fills all bins from 0 to 199 with integers from 0 to 199.

If you want to put numbers from a table into consecutive bins, then define first a variable which assigns a length to the list (useful for later reference)

```
0 VARIABLE N
```

Then

```
XSTORE DUP N ! 0 D X N@I -
PUT LOOP ;
```

and enter the list.

```
1 3 7 2 6 9 4 5 2 1  10 XSTORE
X 5 SHOW  returns 9
```

The following program sorts a set of numbers into ascending order by means of a bubble sort.
(The storing of the numbers has initialised N.)

We shall now need to compare the first of these with the second and swap them over if they are in the wrong order. Doing this N 1 times will float the largest to the top. So we define.

```
: FLOAT 0 DO X I GET X I 1+ GET
2DUP
>IF X  I PUT X>I 1+ PUT ELSE DROP
 DROP
 THEN LOOP ;
```

What does 1 FLOAT do? It gets the contents of X 0 and X 1, duplicates them since comparison will remove them from the stack, and swap-stores them if they are in the wrong order (i.e. if (X 0) is bigger than (X 1)). If we do this N 1 times we'll have the biggest on top. So we define

```
: COUNT N @ 1 - ;
```

However, each successive run we shall need one less comparison so we define

```
: SORT COUNT 0 DO COUNT I -
FLOAT LOOP ;
```

This last definition repays thinking about since it involves nested loops and contains my recipe for painless programming of such loops. The inner loop is defined and replaced by a single word. The next loop contains the count limit for the inner loop. This way we can fetch the loop counter I in as many of the loops as we want and in any way we want, and no defined loop will *explicitly* contain the loop counter for a further in loop.

I'll repeat this technique. Define the innermost loop so that the only thing necessary to make it run is the count limit. For safety's sake test it by, for example

```
1 FLOAT
```

If it works — carry on out.

So the word SORT will set a count limit for FLOAT which decreases by one count on each run.

Note that the I which appears explicitly in FLOAT is not the same as that which appears explicitly in SORT. The program will take care of this.

As a matter of interest here the FORTH program sorted forty numbers, initially in the reverse order, in 2.6 secs whilst BASIC took 20 seconds. Bubblesort is useless for *large* N, but will here serve as a speed comparison. ■

Gil Filbey is a lecturer in physics at the Polytechnic of the South Bank, London.

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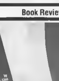

The BASIC Handbook — An Encyclopedia of the BASIC Computer Language by David A Lien (Compusoft Publishing, 360 pages, £11 00)

I must admit that when I first saw this book I could not immediately find a reason for using it Let me explain The BASIC Handbook is an encyclopaedia of the BASIC Computer language inside its covers a wealth of information about BASIC its variations and its add ons can be found The layout of the book is clear and its use is very straightforward However most BASIC interpreters have their own manuals and the number of books that cover the subject of BASIC programming seems to increase daily So why use this particular book?

Well have you ever tried to program your computer using a listing published in a magazine say and developed on a different machine from yours? For a portable language BASIC can on some occasions be very machine dependent especially when a manufacturer or software house has added some new verbs to its instruction set This is where the BASIC Handbook becomes useful

For example assume the program you are listing uses the FIX instruction, and your interpreter rejects the line of program where this occurs The Handbook can be used to explain the function of the FIX instruction and it provides a test program to check whether your interpreter allows its use If it doesn t then the handbook gives you an alternative way that gives the same result Although you will more than likely know your own BASIC interpreter to the extent that you are aware that it does not support instructions such as FIX can you guarantee that you know all the variations of the language? I guess not I certainly learnt some new variations on the BASIC theme (excuse the pun) Do you in fact want or even need to know all the variations of BASIC? Well that is up to you, but if you are in the habit of using programs from various sources then this book may well be for you

The more I examine and use the book the more impressed I am by it it is certainly well worth looking at if you use BASIC programs frequently (especially other people s) The publishers say that they intend to keep the book up to date and to this end I would have preferred a loose-leaf format to its soft cover especially when you consider its cost, which is rather high

---

Z80 Instant Programs — Machine code routines for Nascom and other Z80 computer systems by J. Hopton (Sigma Technical Press, 180 pages, £)

This book is a collection of programs written in the machine code of the Z80 microprocessor The author used a Nascom 1 microcomputer when developing the programs, and Nascom have in fact given their seal of approval to the book The "Instant" Programs vary from simple routines such as a short delay generator to more complex ones including an interactive game called Man against Machine and a digital clock program Although the idea behind the book is good the result I feel leaves a lot to be desired The book is presumably meant for use by beginners in microcomputing who have just purchased/received a machine and don t know what to do with it The bias throughout the book is for the Nascom 1 a fact which is evident from the address space utilised by all the routines Furthermore the lack of assembler and labels in the listings (comments are present at the side of the op codes) makes relocation of the progrms, for use in alternative Z80 based machines tedious and prone to error I am not convinced that the book has been proof read in depth as there are a number of mistakes for example in chapter 5 Here a ramp generating program is used in conjunction with the Ferranti ZN425E a device which appears to confuse as in the circuit diagram given in the book it is wired up as a digital to analogue converter whilst it is referred to as a "simple and cheap analogue to digital converter It is true that this device can be used as an analogue to digital converter but it does require the use of an additional comparator Potential users of the device would be well advised to read the Ferranti data sheet where all will be revealed including the fact that this device has its own internal counter and may be used as a ramp generator without the need for a microcomputer

If as I speculate the intended reader is a newcomer to microcomputing then the information given in Appendix 1 of the book would be very confusing According to the opening sentence and I quote

Normally we count in tens but microprocessors count to the base 8 or 16 this is because these number systems are more compatible with the electronic building blocks used today

Whatever happened to binary and the good old transistor switch — ah those were the days!

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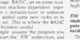

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WHEN WE'RE ALL TEN YEARS OLDER

What shall we see?

In the [illegible] should an old acquaint[illegible] forgotten

Now that the last strains of Auld Lang Syne have died away and the year has turned over to another we have come upon the time that all pundits love more than any other. While the end of any year marks something of a watershed however small there is something special about the end of one decade and the start of another that brings out the best (or worst) in pundits and observers of any activity.

For those activities with a suitable longevity it can be a time for nostalgia, looked back on with fondness at a ten years that has seen many changes some subtle some fundamental. It is also a time for looking forward at what is yet to come.

Unlike the computer industry in general the microcomputer business has not been around long enough to warrant such nostalgia. Most people in the business seem to be so busy running flat out to stay alongside the growth in the marketplace that they seem to have little time left to be nostalgic about yesterday let alone the last few years.

But the next decade the one we have just entered is a different matter. Even though it could be argued as sensible that people need spend little time remembering past times just yet the future is something that has to be considered. It has to be considered for several reasons not least of which is assessing where the market for microcomputer systems is likely to go which other companies are likely to enter the business what technological developments may occur to alter what can be offered to potential customers and the two most important points how these may affect an individual company and what it should do about it.

One of the joys of being a pundit of course is that one accepts no ultimate responsibility for the path the future takes. Everyone can read the prognostications of a pundit on their favourite subject or discipline and throw their hands up in horror screaming, Who is this cretin? How on earth can he make that prediction? What the hell does he know about it anyway?

Quite right, quite right. Any individual's opinion is as valid or invalid as the next's. But whether right or wrong the pundit has made someone THINK (to plagiarise IBM) simply by having the temerity to voice an opinion. By thinking that person has also had to analyse his own views and opinions for their validity. When it comes to thinking about business and its future growth and well being that can be no bad thing.

So it is that I shall now endeavour to fill in some of the picture that I see evolving over the next ten years. Whether I am right or wrong by 1989 is immaterial (although be warned I shall gloat like crazy if I'm right). I do not run a microcomputer manufacturing company, I don't distribute microcomputers or retail them. I don't write software for them or configure systems round them. I don't have an application immediately to hand that requires one. Most of you out there probably fit at least one of those categories. What follows now is no gospel just something to make you think one out for yourself.

Pehaps the most important potential event over the next decade is going to be what happens to the big companies. By that I mean not Apple, Commodore Tandy *et al*, with all due respect to them. In computer industry terms they are still relatively small fry.

The companies that need to be watched closely over the next few years are the giants of the mainframe and minicomputer industries — companies like IBM Digital Equipment and Honeywell together with the big communications companies such as AT&T.

The reason they should be watched is that though the micro- personal small-business computer market is relatively small at the moment in their terms its growth rates are alarming. Where other industries have done well to achieve double figure percentage growths in a year the microcomputer business measures growth rates in months. And those rates are in double figures more often than not.

Already Apple in the States which like many companies in the business dislikes giving out financial figures is reckoned to be heading for a $100 million turnover this year. Last year it was around the $15 million mark. Sit down and work it out. That is one hell of a growth rate.

If such performance can be maintained then it will not be long before such companies significantly impinge on the markets of the existing giants. In any case those same giants are looking increasingly downwards in the scale of many of their new products. IBM for example has been working on the development of a small personal computer for some time and not just for fun. They see a potential application for systems of this type in the future as integrated communications networks for both business and domestic use spread and increase in capability. There is going to be a big market in the intelligent terminals needed to hang onto the end of such networks. The well-known names of the personal computer business are however already producing systems that basically fit the bill.

As the new communications networks become more and more an integral part of the computer system it is likely that companies such as IBM will go for the complete package and produce new low-cost intelligent terminals that will be not unlike present personal computers. The size of the existing market for such systems will be an added attraction for they will be able to sell the terminals as stand-alone units as well as components of the network and system.

For that reason there is a chance that the whole structure of the microcomputer market may change dramatically and that the current names of the personal computer business could become threatened in their position and could even become extinct.

The major development in personal computer systems themselves is likely to come in software which is still the prime stumbling block of the business. Given the generally accepted fact that the software currently available is rarely up to the needs of the first time user especially in the realm of being idiot-proof it is fairly easy to predict that there will be several new developments in this area.

What this will mean of course is that the systems on which the software is run will

The Future

have to get larger. Memory sizes will almost certainly grow to the point where 64k bytes is the minimum, while secondary storage, more and more in the form of hard disk sub systems based on the mini Winchester drive, will normally be in the 20 to 30 megabytes range. It is always likely that bubble memory will actually come along to supplant hard disks, though when this starts happening it is going to depend very much on the price at which memory systems using the part can be produced.

Such large memory systems are also liable to need 16 bit microprocessors to make them really effective, and as the offerings from Motorola and Zilog come available to join the Intel 8086 there will be once again a little bit of a technology fetish creeping in. Users will by that time be hopefully more knowledgeable about what it is they are buying and will understand that it matters little whether the SYSTEM is powered by electronics or steam, so long as it provides the solution to his problems.

Now, most of what has gone before has related to systems aimed at what is coming to be called occupational applications, i.e. applications where the system is used in pursuance of work or occupation. There has been little for the individual, the truly personal user.

Now there are no doubt many reasons why that particular market has never become significant, but one of the main ones is that compared to the likes of television and hi fi a computer does not really offer the punter that much unless he is someone already very interested in the subject.

That interest could well be nourished and expanded by developments in speech recognition and synthesis. Once a user can talk to a computer, and it can talk back, then the possibilities and interest are endless. Though there is much work to be done here, especially in the area of better algorithms, this is something that is bound to come.

With the propensity of the semiconductor industry to compress more and more into less and less, there is a strong chance that by the end of the decade there will be hand held talking computers that are worthy of the name. This is when the true personal market will develop and probably explode.

Talking about the semiconductor industry, there is probably room for just a word or two about what might happen in this area during the next ten years.

On the product front two things seem certain. The next big item is going to be the 256K bit random access memory. Several companies, including the NEB backed UK company Inmos, are already looking towards such a device and it seems likely that by the time the 64k bit part is in mass market use announcements will start filtering through on the bigger memory.

The other new market for the semiconductor companies (though not as such a new product) will be firmware modules. Taken with the expected development in software, this technique of committing programs to silicon in the form of either ROMs or PROMs could form a significant breakthrough in the mass marketing of software applications packages. It would be of interest to the semiconductor companies certainly, for it would give them another outlet for selling silicon based products. It will also be of interest to computer and systems houses as a way of rapidly configuring new systems.

At present the snag in the sentiment here is that the existing software is not necessarily worth committing to silicon, and with ROMs of course there is the added problem of making sure a program is fully debugged before producing firmware from it. It will be some time before complete applications packages come in this form, but it will happen. The semiconductor industry already recognises this and is producing small firmware modules such as arithmetic routines and specialised packages for calculators and TV games. It may not be too long before payroll chips can be bought off the shelf. ■

Martin Banks is [illegible] of Computer Weekly [illegible] the column for Computer Age. It is published [illegible] Computer Weekly with permission [illegible] Martin Banks a regular columnist.

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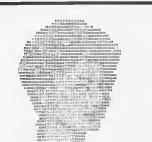

DATABASE

Part 2

In a previous article, introductory concepts on database file structures and management information general purpose systems were introduced. This article examines how the management information deals with handling and validation of data and with report generation.

Data management and validation

Once the data is stored into the database, the three basic management operations that one can perform on a sequential file are **INPUT**, **UPDATE** and **DELETE**.

I shall illustrate the meaning of these and other operations using a hierachical structure, by referring back to figure 2 which appeared in the first issue of *Computer Age* (Dec. 79). It might perhaps help to indicate the order in which records are retrieved. Basically, starting from the beginning of the file, pointers are followed through, using the arrows or addresses, bearing in mind the highest level that needs to be scanned. If the retrieval request only involves the lowest level, that of DEPTC, DEPTN and MANC, then records are retrieved through their *first* level only, as follows:

record 1: DEPTC 1, DEPTN1, MANC1
record 2. DEPTC 2, DEPTN2 MANC2

If, however, the request involves the *second* level of the DEPARTMENT file as well, then records are retrieved as follows:

record 1: DEPTC1, DEPTNI, MANC1, EMPC2
record 2: DEPTC1, DEPTNI, MANC1, EMPC3
record 3: DEPTC2, DEPTN2, MANC2, EMPC1
record 4: DEPTC2, DEPTN2, MANC2, EMPC4
record 5: DEPTC2, DEPTN2, MANC2, EMPC6

Not all levels in a file need be maintained in sorted order. However, assuming that the two levels in figure 2 are maintained in alphabetical sorted order of DEPTC and EMPC, that a new employee EMPC6 joins the department coded DEPTC2, and that a new department DEPC3 is created with one employee EMPC7, then an operation such as **INPUT** will *add* the record DEPTC3, DEPTN3, MANC3, EMPC7.

However, such an operation should not create any new entry for DEPTC2 but

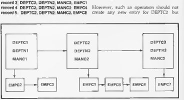

Fig. 6

should only *append* EMPC6 to follow the list of employees already attached to department DEPTC2. Assume further that employee EMPC4 leaves the firm, then a DELETE operation will *remove* its corresponding entry, so that the file now looks like (see figure 6).

What about the **UPDATE** operation? This is easily understood through an example whereby information on some field needs to be changed though other fields in a record remain as they are. For instance if the manager of a department is a spinster who gets married then her maiden name is updated into her married name.

Many different refinements to the above three basic data management operations are possible. The above operations were described in the case where an individual record is added, updated or deleted. Two typical extensions of this idea are *matching/screening* and *global* changes.

In the matching case, only those records which have keys which match those of the incoming transactions and/or obey some screening conditions will be changed.

Global changes imply that a change applies to *all* records of a file. Clearly some *validation* is needed before any new piece of information can be made part of the database. The ideal situation when keying in records direct to disk is to validate each data management transaction — in other words each potential record — individually. In this manner if the record fails the check the user can take immediate action before passing to the next transaction. Though very appealing, particularly when a VDU screen is used, this mode of data entry is not always most appropriate when there are a large number of transactions which have to be keyed in. Indeed, in its simplest form validation of the value of a data field is equivalent to checking whether this value belongs to, or is excluded from the set of values.

'Many different refinements are possible'

For instance validation of a numeric field often amounts to checking the lower and upper limits allowable for this field. On the other hand validation of either a numeric or textual field often requires matching this field against a set of values. If these values are a priori known to the programmer, then it will be easy for them to be included into the validating program. This of course has the drawback that if these validating values change the program has to be changed. A way out is to get the program to read these values from a separate small data file.

Notwithstanding the above the most common validation case is where the validating values are *part of* the data stored in the database. Indeed the one that arises most often is when validating a record by keys and action is taken according to whether the corresponding key already belongs to the database or not. In this case one could easily have to perform one complete pass through the database for each record entered, which could often be prohibitive on computer time. It is for this reason that direct validation of records one by one as they are keyed in is not always possible. The problem is made easier if the incoming transaction records are sorted in the same order and according to the same keys as those in the database which is not always the case.

The alternative is therefore to allow incoming transactions to be processed in batches, which are then sorted as needed and validated. Records failing validation checks are then rejected for further amendments.

An interesting digression may be made here in respect of the cybernetics of the validation system and indeed any system which should incorporate the psychology of the user. Those records rejected by the validation program for further amendments by the user should in my opinion be retrieved by the latter in exactly the same format as when they were first entered. This approach puts less stress on the user in terms of having to know or memorise two aspects of the validation system and their relation rather than to know just one. Feedback happens to be more fluid that way as well.

It is unfortunate that many systems designers have not been concerned enough with the concept of the total system restricting their consideration to what was perceived from notions of hardware and software at the expense of the user as a component of the totally integrated system. A very simple rule, one I have found helpful in practice, is to try to minimise the number of operations, both physical and mental, which a user has to perform when interacting with the computer system.

Some further points might be made on the technical and conceptual aspects of a validation system. Validation of a single field was described earlier as checking that a particular value for that field belonged to some well defined set of possible or allowable values. This however is insufficient in that it ignores the concept of relations either between fields of the same record or between fields of different records. Those relations should be perceived by the system designer at the earliest possible stage in the development of the system. The framework of the relational database approach nowadays equips the system designer with adequate tools to assist him in this task.

Once identified, relations should be extracted from the data in the database and embedded into the programs or treated as parameters to the programs in the system. The less relations in the data the better the system, particularly from two points of view: that of the continuous maintenance of the data and that of the efficiency of the programs in the system.

This latter point requires further comment. It is not feasible in many instances to ensure relations-free data. Indeed as an example consider a record of employees charging rates and time worked in an engineering industry. The actual charge to be invoiced could in the simplest case be the *time* worked multiplied by the *rate* worked out each week say. If the cumulative charge on a given project ever since its inception is required it could be computed over all weeks and summed up. The volume of information storage in this approach might, however, be forbidding, particularly when rates are frequently changed. One alternative is to maintain a separate field, call it *charge* in addition to those of rate and time, and to only keep track of the cumulative value to-date of this field as well as that of the time worked. This, of couese embeds relations within the data. Recovery procedures for this latter approach are however, more complex in case of the failure of some component of the system.

'What can the user ask for in a report request?'

More can be said about the practical implementation of validation in data management. This will be left until a later article. The approach taken in the general purpose database management system which I have been developing on my own micro computer, is that of an integrated design. Validation in this respect is uniformly conceived for data management and report generation. As such it is more appropriate at this stage to explore some aspects of report generation before returning to validation later.

Report generation

As mentioned earlier one of the main advantages of a database management system is the ability to automatically perform standard routine programming tasks such as *sorting* and *report formatting*. These tasks if they are to be written in a language such as BASIC or FORTRAN for each report might take much time for programming. What the database management information system approach does, is to relieve the user from these tasks so as to let him concentrate on *defining* the nature and content of his report request, rather than on how to do it. Of couese, if the database management information system is appropriate the user need no longer know much about programming, and should be able to express his request in a high level language resembling English say

Granted this ease of use, what can the user ask for in a report request? The request should contain the name or names of the file(s) from which the data is to be drawn, naturally Further some indication must be given as to the nature of the operation to be performed on the data file: It could be the plain printing of the data fields or it could be a request for summing up certain of the computational field with perhaps sub-totals, column-totals and/or row totals as needed

Further, the formatting aspect of the request might specify which fields should be considered as *row locators* that is that a break in the rows of the report should occur each time the value of the row locators changes Additionally the report request should specify some screening conditions used for selecting only those records which are required for the report

On the cosmetic aspect of report writing, automatic page numbering and printing of the column headings should be standard The user should be able to specify at run time, a global heading for the report as well as column heading if these are to be different from the ones stored in the file description

Some examples might make the above much clearer The *report request* appears in block letters, with a short explanation when needed

EXAMPLE 1

REPORT REQUEST	NOTES
TABLE	report, rather than data management
HEADING	Global heading for the report
'LIST OF EMPLOYEES' AS FOUND IN DATABASE	content of the heading
FILE PERSONNEL	from personnel file
PRINT EMPC AS 'CODE' AND EMPN AS 'NAME'	
END	terminates the request

The report will then appear as follows based on the EMPLOYEE file as show in figure 3 (*Computer Age* Issue 1)

```
PAGE 1
LIST OF EMPLOYEES
AS FOUND IN DATABASE
CODE            NAME
AL              ALAN
JA              JACK
JI              JIM
JO              JOHN
ST              STEVEN
```

EXAMPLE 2

```
TABLE
HEADING
LIST OF EMPLOYEE CODES BY DEPARTMENT
FILE DEPARTMENT
PRINT EMPC AS EMPLOYEE CODE'
BY DEPTC AS 'DEPARTMENT CODE'
BY DEPTN AS 'DEPARTMENT NAME'
BY MANC AS MANAGER, CODE
END
```

Again from figure 3 but this time based on the DEPARTMENT file only the report will appear as follows (figure 7 below)

EXAMPLE 3

And now for a more complex example involving the two files EMPLOYER and DEPARTMENT If these files were linked together by pointers, as described in figure 5, then the system should consider that the DEPARTMENT file contains all the relevant information on employees as well and a report can be extracted from it on the line of the two examples above I however, want here to assume that there are no pointers and illustrate how the request might be on files *not* related by pointers

```
TABLE
FILE DEPARTMENT
PRINT DEPTN
BY EMPC
STORE            )stores information to-date,
                 )keyed on EMPC
FILE EMPLOYEE
PRINT SALARY AND EMPN BY EMPC
HOLD             )holds information to-date
```

```
LIST OF EMPLOYEE CODES BY DEPARTMENT
DEPARTMENT       DEPARTMENT       MANAGEP          EMPLOYEE
CODE             NAME             CODE             CODE
AC               ACCOUNTS         JA               JA
                                                   JI
MA               MARKETING        JO               AL
                                                   JO
                                                   ST
```

figure 7

```
EMPC             DEPTN            SALARY           EMPN
AL               MARKETING        10000            ALAN
JA               ACCOUNTS         15000            JACK
JI               ACCOUNTS          8000            JIM
JO               MARKETING        15000            JOHN
ST               MARKETING         5000            STEVEN
```

figure 8

At this stage the report request is not complete yet but it might be useful to describe how the information is now held in memory in a temporary file named HOLD (figure 8 below)

The remainder of the request might now follow

```
FILE HOLD
HEADING SALARIES BY DEPARTMENT'
PRINT SALARY
BY DEPTN AS 'DEPARTMENT'
BY EMPN AS 'NAME'
ON DEPTN SUB TOTAL          )sub-total of sal-
                             ary by depart-
                             ment
ON DEPTN PAGE-BREAK         )new page per
                             department
END
```

The report will then appear in two pages as

```
PAGE 1
SALARIES BY DEPARTMENT
DEPARTMENT       NAME          SALARY
ACCOUNTS         JACK           15000
                 JIM             8000
SUB-TOTAL FOR ACCOUNTS          23000
```

```
PAGE 2
SALARIES BY DEPARTMENT
DEPARTMENT       NAME          SALARY
MARKETING        ALAN           10000
                 JOHN           15000
                 STEVEN          5000
SUB-TOTAL FOR MARKETING         30000
```

EXAMPLE 4

As a final example it might be that the information in example 3 was only needed for the marketing department Then the following request will take care of it

```
TABLE
FILE DEPARTMENT
PRINT DEPTN
BY EMPC IF DEPTN IS MARKETING
STORE
FILE EMPLOYEE
PRINT SALARY AND EMPN BY EMPC
HOLD
FILE HOLD
HEADING 'SALARIES FOR MARKETING
DEPARTMENT'
PRINT SALARY AND COLUMN-TOTAL
BY EMPN AS 'NAME'
END
```

By comparing the above to example 3 the reader will convince himself without trouble that the following report will be obtained

```
PAGE 1
SALARIES FOR MARKETING DEPARTMENT
NAME             SALARY
ALAN             10000
JOHN             15000
STEVEN            5000
TOTAL            30000
```

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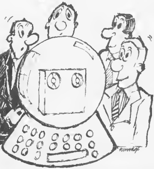
THE STUMBLING BLOCK



Shrinking hardware — yes

But can software follow?

The author UK Manager of Cincom Systems argues that high level software will come to the micro just as it did to the mini

This article looks at the decrease in hardware size from mainframe through mini to micro and asks, Can software follow this trend and apply database thinking to small machines?

Like all articles looking at the future of any aspect of the computer industry I am indulging in gazing at a crystal ball to some extent However whilst the industry is relatively new and extremely dynamic, it also offers some advantages to the fortune teller In the twenty or so years of true commercial data processing we have seen changes in technology and application which are only paralleled in many older industries over far longer periods

The move through first generation second generation mini and micro computers has been well documented many times However this miniaturisation of power is only discussed in terms of pure hardware and not as a function of software — an area of both growing importance and cost

"2000 — when you'll get the hardware free with software "

End users today have far higher expectations of data processing than hitherto These expectations have in general come about through the move away from mainframe installations burdened by the implementation inheritance of second generation batch systems with perhaps scattered on line enquiry and data entry applications

Better communications facilities combined with cheaper advanced hardware technology and advanced software technology has changed the game The current mini user wants the advances in software technology *without reverting to mainframe thinking* The trend is for prospective buyers of minis to look for COBOL and a standard database management system as the means of taking full advantage of the technology leaving traditional mainframe users with little room to manoeuvre they having built many entwined computer applications using second generation methods of sequential and indexed files with no data independence at program level

So, as we can see a level of user expectation has evolved with the advent of minis and associated software technology to the point where it is questionable as to whether a prospective first time user should listen to the hardware salesman and purchase a machine claimed to contain the power and space suitable for his application (and, to be fair a good level of non-selective bespoke software)? Or should the user identify the software he wants, with the help of specialist advice, and evaluate the machine to fit these needs? This approach makes even more sense in the light of the cliche which says software costs are going to represent expenditures with orders of magnitude greater than hardware costs until the year 2000 — when you'll get the hardware free with software!

In truth this may not quite be the case However relative costs are moving that way and the importance of hardware is diminishing But hardware will always be necessary to run software and if our brave new world of computing is to offer high level sophisticated database type software to a broad spectrum of users there are really only two routes One is the growth of networks centring on huge hardware configurations in the hands of computer barons dictating the range of software available The other is the continued reduction of hardware costs and size, plus the application by software companies to tightening up their products to fit progressively smaller machines

So back to the original hypothesis of the continuing downward move of sophisticated software to match the small machines and thus the small user

Marketing

We know database technology is available on minis, but will such software technology come to "smaller than mini" users?

There are various sub-mini machines on the market, they may be described as minis in the promotional blurb but in no way do they meet the generally accepted performance criteria accepted for a full mini Dispensing, though in no defamatory matter, with this particular hybrid the obvious move for high-level software is to micros

> *"The growth of networks centring on huge hardware configurations in the hands of computer barons dictating the range of software available "*

Whilst I personally don't believe the there'll soon be one in every home argument their potential is incredible The books, magazines and national newspaper space devoted to micros has given the possible user an enormous impression of the micro's capability Unless one is connected to the computer industry it would be easy to think micros are small computers with the capability of large computers, whatever that may be

But, according to various gurus of the micro revolution the stumbling block is software Micros, to date have few facilities for handling volume data their use being mainly restricted to processing a limited number of transactions The need has not been there and with the technology moving so rapidly, a full commitment by a manufacturer to last week's state-of the-art machine would have been foolish

Micros will respond to the minis as the mini did to the mainframe History and evolution are against the continued high volume sales of the mini Already Cobol is available on micros, database management will follow The downward growth of software will continue in spite of the "free hardware" argument Whilst hardware technology comes upwards not in size but capability, this expanding market must be met by software suppliers who in their own way are developing such tight compact techniques as to realise the possibility and market for the level of product required by a new and quickly expanding generation of user There will always be big computers and small computers Vast three-dimensional weather maps of Europe will need the CRAY 1 or CDC STAR. We, as users, need the easiest and least expensive solutions the market can offer And in both hardware and software the days of steamrollers cracking walnuts are over ■

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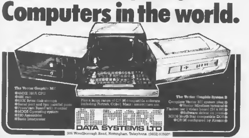

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ACCOUNTANTS' GUIDE TO MICROCOMPUTERS

The second article in the series Aimed at accountants, useful for anyone at the business end of computing

Last month I discussed the considerations you should have in selecting microcomputer equipment with particular regard to the capacity of the equipment to deal with your, or your clients, requirements and any problems of expansion I also discussed the importance of security of information recommending the purchase of equipment on which the user can easily "back up" all information

In this article I will deal with some general points to consider when advising your clients on selecting programs for the microcomputer In my next article I will make suggestions as to the profitable use of a microcomputer in your own office

Mike Kusmirak in his natural habitat

Yoshi Imamura

It is estimated that a small army of programmers will be needed over the next few years to meet the demand for programming of microcomputers There are one or two well-known companies such as CAP CPP who have set up specialist departments to deal with these but in the main the companies offering programming services are of two types

- firstly the person who has bought a microcomputer written a few programs of his own and then set himself up as a specialist software house Study any software produced by this person or company *very* carefully You will need to spend quite some time (in days rather than hours) in evaluating it
- secondly the person who has worked in the computer industry for a number of years for a larger company and has now set up on his own Many of my readers will have had the same experience themselves as accountants Look carefully at what they can show you probe their background, find out whether they understand the *commercial* requirements of your clients ask yourself whether they are professional enough for you to associate yourself with

In both cases spend time testing thoroughly the programs you have been shown Ask to be shown software that the programming house can claim is 'bug free' i e has no errors If errors occur during your tests look for another software house Do not rely on promises only realities

In most cases the suppliers of microcomputer software will not have a large number of existing clients so it will be necessary to study the wares more thoroughly than the company Talk to existing users and find out about any limitations in software supplied and the number and type of error encountered Find out what changes have been needed and what support and speed of response has been forthcoming Check the quality of documentation — if it is not clear to you it will probably not be clear to your clients

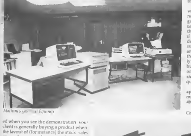
The computer industry sometimes seems to be full of people who make big promises but fail to perform. In today's market there are many who seem to be in it for the "fast buck" and having made it will disappear and go elsewhere leaving dissatisfied customers behind — make certain none of your clients are those customers. In fact, be concerned that the supplier (of hardware and software) knows his product and your client's problem — and ignore any companies where it becomes evident that knowledge is skin deep and everything is "show".

Two Waya

There are two ways for your clients to buy programs —

- Package
- Tailor made

In the case of package programs, i.e. those that can be demonstrated in the way that they will run and are fully documented when you see the demonstration, your client is generally buying a product when the layout of (for instance) the stock, sales or purchase records are pre-determined, with possibly some scope for minor alterations.



Machines [illegible] Equinox

A tailor-made program will allow your client to select his own formats and the structure of the package will be related to the needs of his business. Tailor made programs will obviously cost a lot more than package programs but will more likely suit the needs of your client.

In either case, you should recommend that your client has a thorough analysis of his system requirements prepared, either by a member of your staff or an outside firm. Based on that systems specification you should be able to approach a selection of software houses for a quotation as to price and delivery time for the required programs. But please remember not to buy purely on price — quality is more important. Do not forget that you will have to audit the results produced by the computer (as might also the VATman and the taxman).

Accountants

Back to the points I made earlier on the capacity of a system and the security of a system.

Any hardware system your client buys should be able to cope with his requirements for the next three to five years. It is therefore important to make a careful analysis of those requirements and to make it clear to the software house that the system (hardware and software) should be able to cope with them. If the software house cannot give the necessary assurances, then it is not the right company for your client.

Good software houses will be using equipment from hardware suppliers who supply equipment to meet the needs of both smaller and larger companies. The software that is supplied should be capable of running on both floppy and cartridge disks to meet those expansion requirements.

On the question of security of a system it is important to check whether the software supplier incorporates back up and other security procedures into his software. "Back up" means the ability to recreate easily the data files if any damage is done to the media (i.e. the disks). The process should be a simple one because most microcomputer systems will be going into businesses without any previous computer experience. For this reason, and because its back up requirements are quite cumbersome, I do feel that the Winchester type of disk drive which is currently appearing on the hobbyist scene is not suitable generally for commercial applications.

Other security procedures should ensure that no unauthorised person can use the applications programs or look at the data files at all, and that no-one, unless specifically approved, should be able to have access to the program files or listings.

Finally, what should be paid for software? Regrettably this is a question I cannot answer other than to point out that a good software house will spend a lot of time developing good software — and all that time needs to be paid for. I think that if the software does what it is supposed to do, and the software house is capable of supporting and upgrading its software and understands your client's problems, then any reasonable rate charged is usually justified. If your client has a limited budget, then it is better that he spends it on *one or two* packages of good quality rather than lots of packages of poor quality.

In the next issue, I will deal with some applications where the microcomputer might be used both practically and profitably in your own office. ■

Mike Kusmirak is the M.D. of Equinox Computer Systems Limited.

Packa[illegible] all business [illegible] PETACT [illegible] with diskette drives [illegible]

WHAT IT MEANS

The Editor asked Peter Reynolds to cast an eye over the articles for the professional and businessman in our first issue and explain those terms which he thought might baffle some readers. If you would like terms used in other issues explained please drop Peter a line at Jargon Hunting, Computer Age, 4 Valentine Place, London SE1. He is an executive of a firm of management consultants and cannot be contacted by phone at our offices.

> 'Business never works at a constant level throughout a year'

Computer applications often seem to have as much specialist user jargon special to their own way of working as does computing itself. The first issue of CA included some interesting articles about business applications which necessarily used a number of terms which may be unfamiliar to readers who have not themselves been involved in those specific business activities. Yet a production manager, or someone helping to solve a production manager's computing problems, can learn a good deal from the way a sales manager uses a computer, much as someone wrestling with an Apple may learn from the experience of someone with a PET (or for that matter an IBM System 3 or even 38 series). So here is some explanatory comment on the special terms used in the business articles in **issue number one** of *Computer Age*.

Sales and Marketing Applications
(Article by Tim Wickes)

A *sales manager* is concerned primarily with customers or a subset of a firm's customers, possibly those in a specified *geographical area*. It is his business to know these customers and their requirements and to service them through his *sales force* of individual *representatives*. Each salesman or representative normally has his own *territory* or *district* in which are located his *customers* (those who have already placed orders for his firm's products) and other *prospects* (those who because of their activities and situation are thought potentially capable of placing orders in the future). Each salesman will maintain a daily (possibly weekly) *call sheet* itemising the customers and prospects on whom he is due to call in that period. The salesman will normally maintain a *call record* (or daily/weekly salesman's report) on which he will show the date and time of each call, the name and organisational position of his *contact* with whom he dealt and of course a note of any *sales order* he succeeded in taking or would hope to secure in a later visit.

In addition, when an order is actually *booked*, the salesman will normally open or update a *customer record card* on which he will record not only each order as it is taken but also details of agreed *terms and conditions* of business and brief facts about

Definitions

the customer's business that may help him in future to anticipate the sort of orders he should hope to achieve from that customer and for what products.

A diligent salesman or sales manager may also collect some of this sort of information from prospects who are not yet customers, and compile a record showing the range of products that each prospective customer is keeping and the names of the competitors' products that he is buying or stocking. By computer selection from such a data base it is possible to produce [illegible] *product analyses* itemising all known prospects who are likely to be interested in a particular product that the company currently has on offer. This will of course be particularly useful to the sales representatives for *campaigns* at the time of introducing a new or improved product or of lowering the price of an old one, and it may also be used to compile a *mailing list* of addresses to whom sales material might be posted with a view to generating enquiries to which the salesman would respond by personal call.

As Tim Wickes pointed out in his marketing article, it can be very valuable to a sales manager to be able to reduce at short notice carefully selected lists of sales prospects including, of course, existing customers who do not currently take that line of product.

Business never works at a constant level throughout a year but is subject to fluctuations, whether of consumer demand or due simply to something associated with the times when purchasers find it easy to get their orders accepted. Either way, this a factor that the sales manager must be aware of, and, naturally, a very good way of determining this is to start by analysing the *history of orders* taken over past periods and possibly *plotting* it graphically. Such an analysis may also reveal the extent of the *pipeline* in the ordering and distribution system. Just as winter clothes, for instance, are typically made in the spring, distributed to retailers in the summer and begin to be sold to customers in the autumn for wear in the winter, so with a large variety of products there is a significant lag between the placing of the order and its ultimate satisfaction. A knowledge and understanding of that pipeline can be very helpful for a sales manager in *forecasting* what *demand* he should expect for his product especially when for one reason or another the pipeline is either *extended* or *shortened*, so creating an artificial fluctuation in the apparent demand at the suppliers' end of the chain. Such a fluctuation is likely to be reversed when the length of the pipeline later returns to normal.

When the pipeline or interval between first *enquiry* and *confirmation* of *order* or even *final delivery* is long there is an increasing danger that the customer will change his mind before the order is completed and, if possible, may even *cancel* or *reduce* the order. Such *lost orders* occur proportionately more frequently with big items and infrequent sales — say, a major computer system order by a university — than with recurring purchases like cases of soup ordered by a supermarket. But where these do arise it can be a very serious thing for the salesman and indeed for the company he works for. Then careful study and analysis of these lost orders (if they are many) is a very important, if somewhat unhappy, computer task. It enables the sales manager to see any pattern of cause and effect against which he may be able to guard in the future.

Again, when the product is not a standard thing supplied off the shelf but rather an assembly or *configuration* put together to meet a customer's particular need, it will normally be necessary to give a *quotation* of cost before the *enquiry* can become a *firm order*. Even where the product is intrinsically standard there may still be a question of quotation to incorporate some special *discount structure* or other allowance reflecting the large *quantity* ordered or the way it is to be *delivered* or any other matter which is negotiable between supplier and customer. As Tim Wickes pointed out, that is another natural application for the computer, because the quotation is normally required in a great hurry in order [illegible] complete the deal, and at the same time t[illegible]. This is particularly important [illegible] cost and other [illegible] which may not always be [illegible] especially if the [illegible] with other [illegible] possibly thr[illegible] of a customer [illegible] units also bring[illegible] supplier but served by [illegible] sales areas [illegible] *contract* or [illegible] which is [illegible] *tion* of the cust[illegible] its importance in the [illegible] subsequent [illegible] ing system.

> *'The marketing manager is not separately identifiable in every organisation.'*

Even if the [illegible] ter its detail[illegible] validity [illegible] *dates* etc [illegible] tion can be sent [illegible] formally *ackno*[illegible]

Whether or not the [illegible] at all, other than the issue [illegible] price list, a number of things of this type have to be checked before the *sales administration* routine really gets started with *order entry*, that is the booking of the customer's firm request to purchase. In addition to the items already mentioned, the order must be checked against any other of the supplier's terms of trading, including for instance *minimum order quantity* (below which the supplier may either raise or surcharge or even refuse delivery at all, preferring such small orders to be satisfied through wholesalers or other distributors) or *product discounts*, that is, reductions on list price which are specific to *product lines* (whoever the customer is) rather than to the customer (whatever the product is). Very often, of course, both kinds of discount will apply and an Original Equipment Manufacturer (OEM) may find that in a single order he is paying a minimum order surcharge (because he only wants two or three of a particular prototype item) and at the same time enjoying a product discount on other items that the supplier is particularly trying to push, while overall he may also get a customer discount because the total value of his order exceeds a certain amount or, again, because the cumulative value of all his orders over the year have exceeded a pre-agreed target.

The *marketing manager* is not separately identifiable in every organisation and his duties will sometimes be combined with those of the sales manager. Where a distinction arises it is that the marketing manager is concerned with *products where the sales manager is concerned with customers* and *prospects*. The marketing manager's task is to make his products intrinsically more attractive than the *competition* and in addition to matters of design and *quality specification* he will also be concerned with *product promotion* and *advertising*.

Why not a computer in your business — by John Braga

This article is very clearly written and I could not detect any jargon or specialist terms needing interpretation.

The Office of the Future — by Howard Peters

The author identifies the *accounting* and *financial administration* functions as those which have longest enjoyed computer processing and distinguishes the traditional *batch bureau* treatment from the newer low cost *interactive* mini computer systems. Most readers will now be familiar with the main characteristic of interactive computing, where an operator at a keyboard *converses* with the machine and receives *responses* to his *enquiries* or *requests* almost instantaneously. They will know that batch work is much slower, but may not fully appreciate that it normally requires several distinct stages, commencing with the clerical preparation of a *coding sheet* for each original *transaction document* (such as a supplier's invoice), and that these coding sheets have to be grouped in *batches* and totalled (to agree with corresponding totals for the documents themselves) before being sent some hours later to a *data preparation* department. There the encoded details are punched into cards or, more recently, entered via special keyboards and machines onto some other machine readable media such as magnetic tape or disk. After this comes the *editing run* wherein simple arithmetic and *validity* *checks* search for and reject any obvious errors. These rejects are then returned to the data preparation department for *correction* and *re-entry*. After this and some more hours later the checked and validated data would then be presented to the main computer program itself joining a *job queue* until the work can be processed. Again, after processing, there may be further queuing for the output to be printed and the work will be stored, typically on a disk, until this can be done and the result, the traditional computer listing or payroll or a batch of sales invoices, will be delivered to the user some hours later yet. Of course, it is not necessarily a bad thing for jobs which are not time critical to be 'batch processed' in this way. Fraud is difficult because too many people are involved for collusion.

The *application software* mentioned by Howard Peters refers to the programs related to the users' specific needs which directly produce results that he can see and use. This is distinguised from the infrastructure of *operating systems* and other *housekeeping* software, of which the user is often completely unaware, as well as the *utilities* like *sort routines* and *editing aids* which make the programmer's work more efficient but do not bring specific usable end results of themselves.

It is very difficult indeed to lay down water-tight distinctions between *mainframe*, *mini computer* and *micro computer* but it is generally agreed that the larger machines should be called 'mainframe' when they tend to be operated by specialist computer departments [illegible] large and heavy in the [illegible] computers and when they [illegible] themselves connected [illegible] or *front-end processor* [illegible] more powerful machines.

Definitions

The micro computer is the now familiar small machine that can sit on one's desk or in a briefcase or vehicle. It will have much less iron in it than a mainframe but may be as powerful in computing characteristics as some of the mainframe machines which are still in productive use.

> 'The microcomputer is the now familiar small machine'

Mini computers are the machines in the middle and, inevitably the classification overlaps each of the other two groups very considerably. A couple of tentative identifiers are that a mini will tend to be designed to work *on line* or interactively rather than in batch mode (though some dedicated minis do have batch capability) and that their price ranges tend to be significantly below that of traditional mainframe machines.

Information is often defined as a useful selection of data (which are in turn the details of individual transactions, such as a purchase or sale).

A summary of sales for a period, or for an area or product over a period counts as information. The diagram to Howard Peters' article makes the distinction clear where *data* stored at the heart of the system yields, after processing, and among other things, a *total information system*. That system serves accounting, personnel and financial management and equally, though possibly through a different set of reporting and retrieval programs, the company records, memoranda and management information.

Big Bureau

This article does not seem to raise any question of business jargon.

The Secretary — a vanishing breed? — by Edward Hawthorne

Possible terms for definition:

Text editing

Golf ball daisywheel printer

Justification

Hardly enough to justify a further section.

Editor's Note [illegible]

BORIS DIPLOMAT

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Two Users

Marlene Brown

THE SMALL SYSTEMS MARKET HOTS UP

ONE

A real-time centralised computer based [illegible] processing accounting functions with management information will play a key role in the London office of Hudsons Freight Services. The basic concept is that a central accounting system should be capable of processing a large volume of paperwork and translating these into intelligible reports for the benefit of both management and clients. The new system, while aiming to improve the quality of financial information, also includes cost reduction as one of its main objectives. The final goal is to have the system operate in the most efficient, speedy and cost effective manner.

The company set its objectives in 1977 and a feasibility study of computer based processing systems was carefully planned by the Financial Director, *Mr Sam Husain* and his team of accountants. "We did our own homework and we did not invite anyone to study our business systems because we felt we were better qualified to specify our own particular requirements," says Mr Husain.

Hudsons looked for the hardware from a reputable company, with a well established performance record, capable of providing adequate support facilities. The initial approach was to Nixdorf, Wang, IBM and Burroughs. "We wanted to keep to the big names because we thought they have a name to protect and we could use that to our advantage," says Husain. It would also be an added advantage if the supplier of the hardware assumed responsibility for the supply of systems software and the production of applications programs.

In June 1978, the company installed a Burroughs 806 at a cost of £37 000 on a lease purchase arrangement with a finance house. "We wanted to have extra leverage. We thought the finance house would be prepared to share the responsibility, if something went wrong," explained Husain.

The Burroughs 806 is a 56KB processor with 9.2 Mbyte dual removable disk unit, control console with 120 cps matrix printer, a 250 lpm printer and two data entry devices with visual display units. "We asked Burroughs to take responsibility for the software but they said they would only do it by delegation to *Trace*," says Husain. Many of the applications are standard Burroughs programs, and Trace wrote the job costing tailored to the user's application requirement. The centralised system would integrate the job costing, purchases, sales, cash books, journals and other accounting functions to provide an accurate financial package interrelated to management information. "Our first objective, a total package comprising hardware and programming, was never realised," says Husain.

Stressing the importance of computerised systems to the freight forwarding industry, Husain says: "Because we are a service industry, computerised systems should have been with us ten years ago and in the UK we are at least five years behind America." He asks: "Is it not possible to achieve a range of packages acceptable to the business of contract freight forwarding? Perhaps there are not enough people to write applications software for our line of business."

Every business user wants successful results out of the computer — speedy and accurate information with reduction of manpower, to name a couple. "We feel there are areas where our system is too slow," says *Mike Thomas*, Hudsons operations manager. "Certain aspects of it have required more input time and there are other areas where we cannot do the things which we were led to believe could be done."

Hudsons London office has 18 accounting and 50 operations staff. Additional operations personnel are dispersed over 17 branches throughout the UK. When putting forward a viable case for computerisation, Hudsons envisioned an ideal opportunity to fully integrate the purchases, sales and job costing systems. This would permit greater control to be exercised centrally, as the details relevant to any particular job can be examined without recourse to the job-files at branches. As the characteristics and requirements of branches are generally similar, a computerised system would provide a complete management package by branch consistently, quickly and reliably. "The speed with which management information is prepared and made available is of the greatest importance in an industry such as freight forwarding, where jobs are undertaken at a moment's notice," says Husain.

The concept of computerisation for the Hudsons Group is not, by any means, a new one. Prior to changes in ownership — Grendon Trust, then Baird & Lane and finally Selection Trust — in 1973, a central computerised system was introduced. The system was geared to a computer bureau, but due to poor planning and inadequate implementation with control procedures, the result was no good. Local management at branches eventually reached a stage where distrust of information produced by the central system forced them to evolve some form of accounting system of their own, whereby they had some means of measuring their performance levels. Computerisation was seriously considered again during 1976, but as an initial stage, it was decided to transfer only the sales system of Hudsons Freight Services onto a computer bureau. Until 1978, the bureau system had been operating successfully, but costs had soared to a level where re-appraisal was necessary.

In early 1978, the accounting functions were phased in. "To start initial runs, Burroughs at Baker Street tested our programs, but we had to bargain very hard to get that computer time because Burroughs had other users," says Mike Thomas.

The system produces a general ledger activity report each month, as well as sales, purchases, cash and job costing reports. The job costing application was specially written by Trace. A job is created on receipt of a new job form from branches. The credit control department will provide credit checks on customers, new accounts will be opened before receipt of the sales and purchase invoices, new customers can be informed about Hudsons Standard Conditions of Trading at an early stage.

To provide the facility for comprehensive job analysis, a job type is indexed while heading up a job record. This eight digit code can be sorted to produce a report of all jobs within the categories stated or any combination of them. The system is intended to produce on demand job costing reports for individual contracts, specific types of contracts and is capable of sorting this information by branch and market.

Each individual job costing report clearly shows each sales invoice amount with its corresponding entries of estimated gross profit and the estimated cost of sales across the seven cost headings produced at the end of each month. This facility will clearly show management the work in progress and the estimated costs to come on any contract. It will also provide a precise picture of the principal financial features of the estimated gross profit expected on a particular job. The report will clearly illustrate all adjustments made and the corresponding effect on estimated gross profits.

A typical mid-range computer   7. The PDP 11/44 [illegible]

The computer produces a batch of job costing reports, with branch totals. Similarly, on producing job-costing reports for all branches, the printer will produce company totals. Ad hoc enquiries can be made on any particular job, and a report of all inter-branch sales and purchases will also be produced.

"The concept is that management information must reconcile to financial information, so the computer is a go-between all the time," explains Mr Husain.

The sales ledger accounting system shows debtor age analysis — 30, 60 and 90 day debts over which the balance is outstanding, and the computer produces statements showing outstanding balances and cash outstanding at month's end, or whenever called for.

Creditor analysis linked to a print-out analysis enables the user to introduce a bias as to which vendor will be paid, at the same time specifying the date of payment.

On a monthly basis nearly 500 cheques are produced by the computer, 1300 sales invoices and 2500 purchase invoices, as well as 500 journals where all accruals and pre payments are journalised. The system also produces management accounts for each of the 17 branches and updates the nominal, sales, purchases and job ledgers.

Two Users

"The basic information is being produced, but we want to improve it by speeding it up," says Sam Husain. "Not for one moment do I regret computerisation — it has gone well in terms of having produced what we wanted, but as some programs clearly require further refinement, the next phase of development is being delayed. I cannot progress to that until I am completely satisfied." Hudsons would like to expand the system to produce more information incorporating additional marketing information such as client and activity analysis.

In the Data Processing department, Mike Thomas has two data control clerks to check the accuracy of work received from the branches and two female computer operators. The company [illegible] a lot of emphasis on the planning side to ensure that their inhouse staff [illegible] with the specific application requirements. "We might ultimately opt for our own inhouse programmers because we would like to write our own systems," says Husain, "but it is the mysteries of the hardware that are beyond me." At present, the company employ John Francis Computer Services on an ad hoc basis. "With Francis we have to play it low key because I still have to assess how capable they are and I still have to meet the personalities there," says Husain.

Initial investment in software was £8,000, the total system including hardware and operating costs came to £50 000. "We benefitted financially, largely because we saved on employing accountants all around our branches," says Husain. In the long term, the computerised system saved the company somewhere in the region of £30 000 per annum.

Hudsons still maintain a manual system for their operational and management information, which is stored in working files. Each of the 17 branch managers keeps a job file for easy and immediate access to documentation, so that data produced at the London office correlates to work processed at each branch. "That is why we believe in centralisation, providing decentralised information to all our branch managers," explains Husain. "We would not like to run the risk of denying managers the opportunity of commenting on the financial and management information relative to their [illegible] responsibility. The information must also be meaningful and be capable of being related to the working files," he says.

Future expansion may be considered in three separate phases. Firstly, and of prime importance, to realise the full potential of the hardware capability, and develop software which would produce in depth analytical information and management reports. Thus, client analysis linked to a sales system would be expected to

A typical small business computer   7. The Alpha Microsystem [illegible] produce information on shipment details including destination tonnage type of material margin analysis etc

The second phase is intended to encompass the accounting systems of other companies within the Group These include a substantial property company with industrial property at various locations in the UK a purchasing company an offshore services company a management company and a transport company In most cases, off the shelf programs may be adapted to suit Hudsons own particular requirements This phase will however, not be commenced until such time as all the teething problems are solved and refinement of existing programs completed The third and most ambitious phase is the total integration of operational information with accounting and financial information on an EDP system This plan envisages shipping documentation calculations and others being processed through a computerised system by means of VDUs operated by operations personnel

Two Users

Our present thoughts are to develop systems both accounting and operational Further we will need to follow the same route as in the case of the implementation of the present systems says Sam Husain 'Thus we would form a planning committee whose brief would be to collate statistical information on documentation information required to be processed, and would study in depth the various activities involved Initial research would include talking to Hudsons personnel and studying software and hardware available on the market The objective of the planning committee would be to produce a detailed feasibility report for approval by management Should the proposals be acceptable it is anticipated that quotations and proposals will be invited from various computer companies in order to evaluate the applications and relevant costs Implementing procedures would include staff training on a much wider scale than that adopted for the accounting applications It is expected that in order to successfully implement the third phase mentioned above an inhouse programmer will be called in to work closely with a systems manager accountants and managerial personnel to achieve an acceptable level of success

Hudsons place a great deal of importance on close co-operation with the computer manufacturer or supplier/systems house particularly with regard to use of standard programs computer testing time delivery dates staff training, etc Almost certainly this aspect will play an important part in the initial selection of the computer system to be used

Editor's Note *Burroughs have now announced a massive increase in customer support This includes the opening of a new support training centre in the Haymarket London Other new centres are at Leeds (two) and East Grinstead Sussex Burroughs have [illegible] in the UK and Ireland*

TWO

Uniprint

A small business system from [illegible] has established a permanent [illegible] the offices of *Uniprint* London's instant print shop Set up by *Tony Toller* three years ago, Uniprint uses fast offset printing of high quality for books stationery and sales literature 'Before the computer our administrative costs were high notes Toller 'but now the new system is so comprehensive that it enables me to run the whole accounting package in a matter of two or three hours a day

The company's turnover last year was around £360 000 and the year before they made a net profit of just under £30 000 Toller insists it is far better to have many workers and few chiefs 'That is how you make money in printing he says you churn out as much work as you can in a 40-hour week, and really computerisation is the only way you can achieve this

It all goes back to February last year when Toller met *Derek Rowe* M D of Abacus the systems and peripherals house Rowe came to him on the recommendation of a friend for a fast and efficient printing service Soon after they met they talked about Toller's computer problems and Rowe decided to try putting right what had gone wrong in the past What we are trying to do is to provide a rounded service to understand the needs of the business user and support him in every way because we want him to have less problems than he had before he bought a computer,' says Rowe

The computer has changed the way Uniprint operate and it also altered individual habits It care has been taken at the very beginning if you define precisely what the customer wants to your satisfaction and to his then the machine should settle in nicely and become an indispensable part of his work," says Rowe

As Rowe sees it, this may involve 'Pointing out some home truths to the customer on the bad ways he has been doing things and the new ways you are offering him If anything goes wrong with Mr Toller's system we will whether it costs us money or not go round and do something about it, says Rowe 'Such ethics which abounded in this country at the turn of the century have been dying every since — it is known as service and we provide it

> *"Rowe decided to try putting right what had gone wrong in the past"*

As small computer systems have become more complex in the way of operation and programming to user needs the techniques of good system design and system software requirements should begin we hope to create a better understanding between designers and builders

Emphasising the need to pay close attention but separate attention to both parts Rowe says 'It's no good having a marvellous architect (systems designer) and a marvellous builder (programmer) building out of flimsy bricks nor is it any good having a man who makes the most beautiful reliable bricks and a builder who cannot design well because the damn house will fall down

Tony Toller echoes his remarks saying 'A businessman looking for a computer should first of all find a software house to tailor the system and recommend the right hardware to go with it Don't go and buy the hardware and then start shopping around trying to find someone to do the software' he advises The software house Formdata who operate as a separate company, work exclusively for Abacus Formdata say they have gained an intimate insight into the operations of all Abacus's customers to ensure they provide the right kind of support Formdata has a very good knowledge of how Mr Toller's business works and when they produce an up-date it will include a lot of things which Mr Toller doesn't have to mention because we know exactly what his requirements are" says Rowe Expressing confidence in the system, Toller himself says Abacus hardware needs virtually no maintenance it is well designed and, on top of that we hope has reliable software

In the early days Toller says he did a lot of listening and window shopping Abacus seemed the best because we wanted rather specific software tailoring and they were prepared to design and implement the system from scratch," he says

Every decent installation needs tailoring, says Rowe and beware anybody who says they have an off-the shelf business package because everybody's needs likes dislikes invoices analysis etc are all different"

Uniprint lease the system from Lombard for £198 a month, with an option to purchase at the end of the five year period. Toller says he chose leasing for tax advantages, although he says that if he was buying now he would go for a hire purchase agreement

Starting out in 1976 with the Computer Service Bureau in Ealing, for a purchase and sales ledger program Uniprint then switched over to Star Bookkeeping, paying £80 per month for a low cost package to handle all sales purchase and nominal ledgers finance and accounting As soon as bureau costs touched £120 a month, Toller moved into in-house computing

A typical small [illegible]

The cost of acquiring the complete system from Abacus was £8,300 which includes TEI (Texas Electronic Instruments) equipment — processor with 60 Kbytes of memory floppy disk drives and 1 visual display unit with a Teletype 30 cps printer

The company will soon install a dot matrix 810 printer from Texas Instruments giving greater throughput at a speed of 150 cps and costing only £1200 I would definitely advise anyone getting a system not to bother with a 30 cps printer says Toller Our month-end report takes five and a half hours to print, but it will now take about an hour with the new printer Operating costs cover continuous stationery, designed to double as invoice forms statements and other office supplies

Uniprint has 300 active customers with nearly 600 names and addresses on file As customers are served at the counter data is immediately entered into and validated by the computer The computer raises approximately 100 invoices a week with up to 15 individual items per invoice and copes with 100 suppliers producing 200 invoices per month The system analyses the data from the invoice prepares remittance advice forms for the suppliers and will also generate cheques and invoice analysis by nominal expense account allocating printing costs to a number of different suppliers

Two Users

The analysis of expense falls into two categories either by supplier or nominal expense At the end of each month the system will generate a detailed report on how much is spent on paper light heating and other overheads In addition there is an analysis program on sales In our case it will give a break-down on how many sheets of a particular sort of paper we have sold, how many printing plates and how many books bound which tells us what sales have been made says Toller The figures are then compared with what was actually spent and enables the company to carefully monitor their profit margins on every product line manufactured or sold

Everything is keyed into the computer says Toller who spends nearly two or three hours a day on all accounting procedures, invoice processing cash in and out and administration To do what I do here manually would probably take two full-time staff at a cost of around £10 000 a year he estimates

> *"We do not appear wearing identical brown shirts with brown suits singing the company song "*

Software and hardware maintenance support from Abacus is on an ad hoc basis There were one or two visits in the early days of installation but now all functions are running smoothly The one hardware problem was the overheating of the disk drive caused by blocked air filters but Abacus brought down a replacement straightaway says Toller Most of what you have to do comes up on the screen the machine asks the questions all you do is answer the questions and if you answer them correctly you cannot really go wrong

Rowe says Abacus is lucky to have good customers who pull together when faced with complex problems Tony Toller is a good customer who realises that all new systems have teething problems and he bent over backwards as much as we did to make sure that everything went smoothly

Tony Toller says that Abacus has a reputation for its honest and straightforward approach with users who have a relationship with them As Rowe sees it There is no point in making a fast buck by selling a system where it is not going to fit We do not take what I call the carpet salesman attitude And we do not appear wearing identical brown shirts with brown suits singing the company song We make it quite plain what the business is all about with all its pitfalls and we will only sell if the system is going to suit the business

Derek Rowe insists that a lot of hardware sold by large companies is not understood by any of them Computers are put together usually by some obscure design team in the US, and detailed information which should enable the local field engineer to make minor changes and corrections to suit a particular customer is not available Due to this any bugs in the system that appear to be software related are in fact hardware bugs remain a mystery and the customer remains dissatisfied Small companies tend to fully understand the hardware because some of them actually designed it themselves A number of large suppliers will have to start looking to this smaller to middle end market offer more personal support and stop playing God he warns Your best advertisement is a satisfied customer and if a fraction of a percentage of these large profits were put into customer support then the results will be far better than any amount of advertising says Rowe

Agreeing with Rowe, Toller says It seems to me a very shortsighted policy for suppliers to sell hardware and not give an effective and prompt customer support service Good words spread as fast as lightning in the business world

As all small businessmen are more interested in the price performance of the system they look to the system house for the skill and expertise of software/hardware support and a fast service When things have gone wrong I have not been stuck out here for 24 hours waiting for Abacus says Toller They either come to me immediately or I send the disks down to them and everything is sorted out fairly quickly The Abacus support squad keep track of all Uniprint s programming and processing work offering analytical assistance providing basic management advice and chipping away at problems

When the system was first installed in March 1979 Uniprint took the correct back up procedures There is no need at all to keep manual systems running and you can switch over entirely to computerisation says Rowe Even if the equipment was down for an appreciable length of time it should not be catastrophic and with the right back up procedures it is highly unlikely that all information will be lost

Toller says he sees a distinct difference between programming a computer and using a computer We are printers and we leave computing technology to the skill of computer specialists he says I can use this computer but the actual programs are a complete mystery to me I do not want to know anything about them I do not need to so long as it performs the business functions I want

Two Users

The explosive development of inexpensive micro and mini based small business systems has brought with it a number of complex problems Rowe insists that the biggest disaster stories are from people who have been led to believe that they can improve their business by spending under £1000 on a computer Stay away from the bottom end of the market except to spend an absolute minimum of £4000 ' he warns

[illegible]

Rowe advises the first-time user to look around for businesses in the *same trade* and then view their computer installations "You have to talk to satisfied users listen to their problems and then start making a decision " He warns against over-zealous salesmen, and says Beware the Hi-Fi shops that have started selling imported American hobby computers with small business programs and virtually zero support They are poorly built, badly cooled and if you turn on the vacuum cleaner on the same socket it will screw the system up completely

"Nearly everybody who goes into the computer game thinks they want one thing and it turns out they need something else ' says Tony Toller 'The advice I can give is to go by a satisfied customer and do not believe salesmen ever, he says

The extra hardware now considered will allow much larger disk storage with faster access and faster printing Formdata will provide Uniprint with a commercial software package called VWAS offering additional facilities including stock analysis value of stock sold and quantity sold year to date They will also provide an analysis of the company's current job records

Since computer power became widespread in the small system market the demand for peripherals continues to move ahead Rowe says that because of his connection with *Shou Financial Corporation* the Texas-based company Abacus will now be able to hold in the UK very large stocks of printers, terminals and business systems at competitive prices for instant delivery

Editor's Note *I happen to disagree strongly with Derek Rowe's strictures on packages Horses for courses is as good a piece of advice in computing as in racing And I welcome the computer in the High Street People are becoming more sophisticated and will shop shrewdly whether at the computer supermarket or the computer specialist I commend his emphasis on service and his directness is refreshing in a business that's a minefield of ifs and buts However to want to reserve a special position of expertise is a throwback to the time when customers were as much patronised as sold to Those days are gone irrevocably And salesmen do have their place Perhaps a salesman for some company could write for* Computer Age *giving the salesman's point of view*

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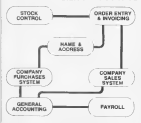

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ROOM AVAILABILITY

The system provides immediate viewing and booking for up to 12 blocks of rooms for 400 days ahead Each block can contain 99 rooms. The theoretical capacity is 1188 rooms per file The room blocks are initially defined and named by the user The program automatically advances the 400 day period as the date progresses The capacity of the system makes it suitable for a small group booking system or similar use A number of files of blocks could, of course, be stored on a disk

On entering a date the screen shows the availability within all the blocks for that date and the following 6 days. Without re-entering a date the display can be stepped backwards and forwards in 7 day steps. Leap years are automatically dealt with and there is a perpetual calendar on instant call

GUEST BILLING

The program caters for about 130 rooms per disk and makes invoicing of guests for accommodation and other services and extras extremely easy. The guests accounts are called by entering their room numbers and services and extras entered by pressing an appropriate key from a menu and then the amount. Final accounts itemise charges and add for VAT and any service charge The printer produces the guest's account and a copy side by side.

The two systems are integrated as one program, but the ROOM AVAILABILITY system is available as a separate program for £275

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AN OPEN FIRE

[illegible]

It may be a sign of cynicism that I inevitably ask myself what the writer's interest is when reading articles on the micro revolution, particularly if the author has any political axe to grind. So let me start by declaring that I work in DP (Data Processing) training, and that mini and microcomputers are the areas in which I specialise. I have a direct monetary interest in as many people as possible knowing as much as possible about small computers and microprocessor applications.

I have a deeper interest than this: how [illegible] I am in my early thirties, with a [illegible] and the quality of my life and the fundamentals of his are liable to be greatly influenced by the new technology. [illegible] that I place no more stress than [illegible] liable to be greatly influenced because [illegible] that many people seem to [illegible] for their own [illegible] that is a choice. Let me give an example at the most frivolous level. I have played backgammon on what is apparently the top selling microcomputer. I would not choose to do so again. There are two reasons. Firstly, it is no better as a game and was in some intangible way less relaxing than two people sitting at a backgammon board. Secondly, and this is an element that may cause many people to exercise the same choice in much more important areas, there was a software error which prevented the final move of the game from being made. It is possible that the fact that I would have won the game influenced me, but the interesting comment made by the machine's owner was that my partner and I were the first people of many who had played the game who had persevered sufficiently to get to the last move.

I am a very occasional chess player. Part of my enjoyment in playing is the visual and tactile contact with beautifully carved chess pieces. I would not choose to play chess on a machine. In the area of games I think it very unlikely that I shall choose to play traditional games on a microcomputer. There may be games devised which are new in themselves which I will prefer, or may only be possible on a machine, but I [illegible]

[illegible]

At the [illegible] may be true [illegible] have their [illegible] Washing machines [illegible] ition and [illegible] long as the engineer [illegible] care to make it. But I [illegible] others do not think [illegible] sufficiently important [illegible] relatively minor technological change [illegible] their design to represent a change in my way of life. In more specialised applications, where we consider motor transport in third world areas for instance, and maintenance is at a very unsophisticated level, the new technology may have some way to go in proving its practicability. Even in this country there are many people who blanch at the thought of buying a car with electronic fuel injection because of maintenance problems. The same people may remember changing the dynamo brushes of their old car and compare the simplicity and cost of this operation with having to replace an alternator on a newer car.

> *"I may even have time to re-thatch my house, become a craftsman."*

As maintenance on consumer items, particularly motor cars, becomes even more hideously expensive, two further, possibly more important factors may well come in for consideration. Firstly, we shall all have more leisure time. Secondly, we may regain in that time the satisfaction of doing things for ourselves, such as maintaining our motor cars. Simplicity of maintenance, and mechanical parts, such as distributor contact breakers, which the reasonably skilled home mechanic can attend to himself may become *selling points*. I know that the use of motor cars as we know it is under threat, but I think that this is another revolution that is grossly exaggerated, and the argument holds for many other consumer durables.

Certainly many houses built in the next twenty years may incorporate some sort of [illegible] have been [illegible] telling [illegible] I installed [illegible] gas cooking, knowing [illegible] happen (as the last [illegible]) all electric neighbours [illegible] cook their dinner and warm [illegible] up. I have no interest anyway [illegible] house controlled by a mi[illegible] and my choice will mean that I [illegible]

Many aspects of my work, and [illegible]ally everybody else in the country, will be fundamentally affected by microprocessors, possibly revolutionised. I look forward to spending less time on my professional job. I shall spend more time with my family, in my garden, on my hobbies. I may even have time to learn to re-thatch my house, become a craftsman. My neighbour may find the time to make furniture and realise that there is time to let the wood for it season properly. I may play cricket twice a week instead of once, and have the time to restore an old car with a carburettor, a distributor (even a magneto) and a crankhandle.

I realise that many people in many industries see the chip as a threat to their way of life. A lot of my parents' generation's ideas, such as having one career for the whole of your working life, have been challenged in the last decade or two; a lot of the present idea that all knowledge, culture and entertainment have to come out of a box in the corner of the room may have to change. I look forward to retiring at fifty (or earlier), not because I dislike my job, but because I have many other things I want to do. I shall always prefer to handle a nicely made book to reading the same information on a VDU screen. Above all I shall exercise choice in whether or not the micro revolution affects the really important parts of my life, and I feel that too few people are saying now that we should be looking forward to being able to make such a choice. ■

Geoff Norman is the training course manager for Infotech.

TOPICS IN ARTIFICIAL INTELLIGENCE

Part Two: Planning a Strategy

Dr. Fairhurst is at the Electronics Laboratories, The University of Kent at Canterbury.

Introduction

The first article of this series examined some of the most elementary considerations of problem specification and representation of which we must be aware in any attempt to endow a computing machine with even a rudimentary form of intelligence. One important point to emerge was that a problem may often conveniently be represented by means of a tree structure, which shows in a visual and easily assimilated form the changing state of a problem domain and the consequences of the possible actions which may be taken at various decision points.

If a tree representation is to be useful beyond its role simply as a method of representing a problem, it is necessary that we begin to consider how its structure can help us to formulate a *strategy* for the effective solution of the problem it describes. Only when such a strategy has been worked out and formalised can we turn to the question of implementation — by means of a suitable computer program or in any other way.

Tree searching

Imagine for a moment that it is possible to draw out a tree structure, not with a pencil on a piece of paper, but using a white line marker on a football pitch. In this sort of situation it would be possible actually to walk along the branches of the tree and visit (literally, in a geographical sense!) any of its nodes. However, unless it were possible to enlist the aid of a helicopter it would be very difficult to see and take in the details of the problem specification *as a whole*. It would be even more difficult to identify some distant goal node at the extremity of the tree and thereby plan a *route* to reach it. Rather, in order to understand the problem — and thereby plan a suitable strategy for its solution — we should have to visit the nodes individually, and preferably, to avoid future confusion, in a relatively systematic way. In other words we need a systematic way of *searching* the tree.

Although the example above is a rather fanciful way of illustrating a tree search, it does nevertheless represent a rather close parallel to the viewpoint of a computer using a tree to plan some course of action, for a computer is equally unable to examine the whole tree simultaneously and must likewise have a systematic means of traversing branches to visit nodes.

In order to illustrate some different techniques for tree searching let us define ano-

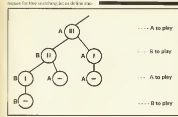

Fig. 0

ther simplified problem. Figure 1 shows a map of Britain on which are marked the five cities Birmingham, Edinburgh, London, Manchester and Norwich. Let us suppose that the *lines* joining these cities on our map denote the air routes between them which are operational on some particular day, while the *figures* on the lines denote the return air fare along that route.

Suppose now that I wish to travel from Birmingham to Edinburgh and back on the day in question, and that I wish to plan a travelling strategy which will enable me to complete the journey for a cost of £70 or less. First, it is clear that we may represent a plan of all possible available air routes (excluding any which involve repeated visits to any one city) in the form of the *tree structure* shown in Figure 2, where the cost of each trip is shown against the corresponding terminating node. We now need to search this tree to see if we can achieve our goal.

One possible search technique which could be used would be to begin at the starting node and move down the tree taking the left-hand branch at every decision point until a terminating node is reached.

If this terminating node is not a goal node then move back to the last decision point encountered, and take the next branch to the right, and so on. This sort of technique would allow the search of our particular tree to visit and search the nodes in the order 1, 2, 4, 9, 15, 10, 5, 11, 12, 16, 3 and finally 6 (the goal node), and is referred to as a *depth-first search*, because it involves moving down to the very tip of one branch before going on to the next.

Alternatively, we could search the tree by moving from the starting node to each of the nodes in turn at the next *level* down, followed by an examination of all the nodes at the level below that, and so on. Using this technique, which is called a *breadth-first search*, the nodes of our tree would be visited in the order 1, 2, 3, 4, 5 and 6 (goal node).

The potential advantages of each searching technique are apparent. The depth-first search can be very powerful and reach a solution very quickly, particularly if many goal nodes exist. The breadth-first procedure, while very methodical, can be wasteful of search time, particularly if searches to a great depth are required. In our particular example, however, a depth-first search would need to search through 12 nodes to find a solution (i.e. it would overlook the very short path to the only goal node until relatively late in the search). In contrast, a search through only 6 nodes would be needed using the breadth-first procedure.

Devising a strategy

Now that we are able to search trees systematically, we are in a position to develop a means of utilising tree-structured representations for planning strategies for problem-solving tasks. To illustrate this, let us return now to the problem area of providing a machine with an ability to compete effectively in some game which

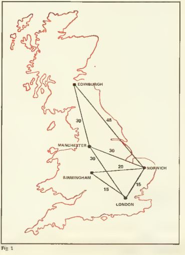

Fig. 1

demands a degree of intelligence on the part of its participants

In the *previous* article we derived a tree to represent a simplified game of NIM in which two players, starting with five straws and playing alternately pick up either one or two straws at each move in such a way as to force the opposing player to pick up the last straw The bottom left-hand corner of that particular tree was as figure 0 (see Issue 2, page 16)

Looking at the bottom-most node we see that this represents a win for player B and we have now indicated this by writing B against that node However if we move back up the tree by one node we see that although it was player A s turn at that node he was left with no alternative but to pick up the last straw This node then also defines a position from which B wins and accordingly it is *also* labelled B At the node above that two straws remain but it is B s turn to play With his knowledge of the *rules of the game* he will not pick up both straws (thereby losing) but will make the rational choice and pick up one straw thereby forcing his opponent to a losing position

Using this sort of reasoning we are able to 'back up' the tree from terminal nodes to determine at each move, which player has a potentially winning position In the diagram above all the nodes of the partial game tree for NIM have been labelled according to this procedure By continuing the backing up as far as the initial node of the overall tree it is easily shown that the first player to move is always able to win and a suitable strategy can then be formulated by going back through the tree move by move For example the backed up tree will show that A is only guaranteed a win if he initially picks up only one straw If he picks up two straws then he loses the initiative to B and will only win if B makes an error (Confirm this by applying the backing up procedure to the entire game tree which was drawn out in the previous article)

Generalising the procedure

In more complex problems it may not be quite so clear as in the previous example that any particular node will lead inevitably to a winning or losing position In chess for example the distribution of pieces on the board at any particular stage in the game may require a very subtle assessment on the part of the player before he can decide on a move which will (in his judgement) increase his chances of gaining further advantage later

If we are to generalise the previous procedure, therefore we must introduce some form of *evaluation function* which will allow us to put into a more tangible form our feelings and intuitions about the current state of the problem In practice this mens that we must be able to assign some numerical value corresponding to a quantitative evaluation to any particular node of the tree For example in the game of chess we might be able to devise an evaluation function which takes account of such factors as the number of chess pieces remaining the relative values of pieces the probability of capture of an opponent s piece at the next move and so on

Let us consider a number of steps in some hypothetical game represented by the arbitary tree of Figure 3 Suppose that at the terminal nodes in this part of the tree we have applied some appropriate evaluation function to generate the values shown In general we shall choose that function in such a way that with respect to player A it generates a higher value for a potentially more advantageous position and a lower value for a potentially less advantageous position Note also that we assume this to be the tree which A has generated to help *him* rather than his opponent plan a winning strategy

Thus player A s efforts are directed at moving through the tree to a node with the highest possible value of evaluation function (the most advantageous position with respect to A) while player B would like to frustrate this endeavour and force A to a position of smallest possible value of evaluation function (the least advantageous position with respect to A)

Let us work upwards from the bottom of the tree again in order to analyse the situation At the middle level of the tree shown in Figure 3 it is B s turn to play He is therefore most likely to choose the branch which will *minimise* A s score at the next move Thus for example at node N_2 B will choose the branch to N_5 or if at N_3 will choose the branch to N_7 Thus from A s point of view at the top level of the tree the nodes N_2 and N_3 have effective values of 4 and 2 respectively, since assuming that B acts logically these values will represent the best that A is likely to achieve at his turn It is clearly in A s best interests to opt for the branch which will *maximise* his potential score From A s point of view again, this argument means that node N_1 has an effective value of 4

Utilising this sort of principle for strategy formation from a tree representation at alternate moves one player is seeking to maximise his score and therefore gain an advantage while his opponent tries to minimise the score in order to keep the potential advantage as small as possible Hence the technique is often referred to as a *minimax* procedure

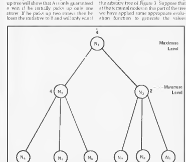

Fig 3

A refinement — tree pruning

The minimax technique is very attractive as a means of planning strategy but for a tree with a large number of nodes the amount of time taken to apply the procedure may be prohibitive However if a technique can be found which allows us to prune the tree by cutting off some branches for the purposes of search and evaluation then this difficulty would at least diminish in significance

In practice it is possible to avoid having to compute evaluation functions for every terminal node Let us consider our previous tree and let us combine the minimax procedure with a depth first search such that the extreme left hand path is evaluated first followed by the next path to the right and so on First evaluation information is passed up the tree from nodes N_4, N_5 and N_6 to node N_2 by selecting the minimal score (i e N_2 is a minimising node) This assigns the score of 4 to node N_2 as in the previous case So far as A is concerned this means that by choosing to branch to node N_2 from N_1 he will assure himself of a score of at least 4 as he moves down the tree in the course of play

In order to determine the score at node N_3 and thus facilitate a decision at N_1, the procedure now moves to node N_6 whose score when evaluated turns out to be 2, a discovery which is of some significance.

Since N_3 is a minimising node it will assume the minimum score among the evaluations of N_6, N_7 and N_8. Thus before examining and evaluating N_7 and N_8 we know that the *largest* score which will be assigned to N_3 will be 2, and this will therefore be a score which is *less* than that already assigned to N_2. Since N_1 is a maximising node this discovery means that A must take the branch from N_1 to N_2 at his first move. The important point is, however, that we have arrived at this conclusion *without* having to evaluate scores for N_7 and N_8. This pruning technique, which effectively excludes certain nodes from the search, can be extended to any level in a tree of any size, and thus provides a means of reducing dramatically the search and evaluation time in using a tree to plan an operational strategy.

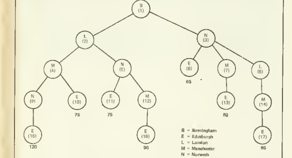

Fig. 2

Some practical considerations

Although this method of strategy formation using tree representation and searching techniques can be very powerful, there is one major problem which must be discussed in conclusion. This arises from the fact that trees for more than the simplest games grow frighteningly quickly. (As an exercise, estimate the total number of possible opening moves and replies in a game of chess.) In fact, it has been estimated that the total number of paths in a complete chess tree is about 10^{120}. Even if we disregard theoretically possible but obviously stupid moves, and consider only 'reasonable' moves it is estimated that the total number of reasonable chess moves in a typical game is about 10^{35} (i.e. 100 000 000 000 000 000 000 000 000 000 000,000 moves!). Even for the simpler game of draughts the corresponding estimate is about 10^{29} moves, while for the increasingly popular Japanese game of GO, the estimate is about 10^{100} reasonable moves. It is an interesting exercise to estimate how long it would take actually to compute all possible reasonable moves in these games — the answers are quite staggering.

To complete this brief introduction to techniques of strategy formation, therefore, an indication is given below of some refinements and shortcuts which might be exploited in tree searching.

- *Limited lookahead*

In a complex game such as chess it is clearly not practicable even to try to generate a complete tree. However, if a tree is grown which will allow a look ahead by even a relatively small number of moves, then at least a short term strategy can be formulated to push towards an advantageous situation at a later stage. At critical stages during play the tree could be extended by a greater than average number of moves.

- *Representational shortcut*

In some cases the search and forward planning can be reduced if some specific characteristics of the problem domain are known and taken into account. For example, if the problem in hand admits a degree of symmetry among various possible steps, then this may lead to moves and/or states which are equivalent and need not therefore be considered separately. (Consider how symmetry might help, for instance, in planning a strategy for playing a game of noughts-and-crosses.)

- *Specialist knowledge*

If the tree searching techniques can be combined with a facility for utilising some specialist knowledge about the particular problem in hand, then planning can be made even more efficient. For example, in chess playing certain "key" board positions might be stored and used to direct a search among a much reduced part of a projected tree, thus removing the requirement for exhaustive search even in the limited lookahead case.

Of course, there is no reason why such refinements — and indeed others — may not be combined. It should be clear, however, even from this introductory survey, that strategy formation underlying intelligent information processing by machine is by no means a trivial matter. Nevertheless, even the simplest techniques can be effective when applied to appropriate situations, and those presented above provide a sound foundation upon which even the beginner, with a little imagination, may build. ■

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CA3

Are we too general?

Though not usually perverse by nature I took exception to your claim to being "The premier computing magazine in Europe" on the basis of your first edition alone and dragging out copies of several other magazines I have took a spot comparison.

I look forward to your second issue if only to see if your proud boast remains. Care to read on?

You fared no worse than the others allowing for the fact that you have yet to establish a reader base but certainly no better. There were times when a quick look at the bottom of the page was necessary to remind myself which magazine I was reading, it's all too too familiar.

The articles were worthy but I question their relevance. Just how many features on computing in education do we need? How does it help me get more out of an MK14? All very nice if you're in a doctor's surgery and would rather read than fidget in the queue.

My critique centres on the fact that this issue was almost entirely devoted to the periphery of computing, almost as if avoiding the subject itself. I long for the advent of a magazine called Practical Programming.

Well how about it? Help us get the most out of our machines not a treatise on whatever the implications of these beasties are. How about an article on overcoming the inherent difficulties of parsing on a byte oriented machine? How about something practical?

Until your next issue

Martin Crumpton, 36 Nethercote Gardens
Solihull Lodge Solihull B90 1BL

Editor's Note My reply to Martin follows

Thank you for your letter. Before attempting a reply to your criticism may I congratulate you on a fine writing style. Now I take your point about practical programming. But a true magazine, as opposed to an academic journal or comic, must be wide in scope, catholic in taste. All the same you will see in the series on artificial intelligence and on writing your own assembler that we are not on the periphery of things. Later when our invitation to people to write for us is increasingly taken up we may have a section — in smaller typeface — which is more specialist and academic. We shall have to see. One thing we are trying to avoid is a concentration on two or three machines to the exclusion of all others.

I am very much for the hobbyist. There are some very good magazines catering for him. Indeed I was previously editor of one of them and am a paid-up member of the Amateur Computer Club. But *Computer Age* is not a magazine for the hobbyist. It's a big world we're living in and *Computer Age* intends to look globally, not parochially at it.

I shall be publishing your letter with pleasure and will be forwarding you a copy of *The Mighty Micro*.

NUMbed

I hope Cal Filbey's grasp of FORTH (CA Dec 79) is more substantial than his grasp of BASIC. The absent NEXT statement may perhaps be blamed on the printers (or non programmer sub-editor) the use of the variable NUM is absurd. The program (page 49) should be using standard variable names

```
10 S = 0
20 FOR I = 1 to 50
30 LET S = S + I
40 NEXT I
50 PRINT S
60 END
```

Apart from this congratulations on the contents, clear printing, neat and informative headings. I have not torn so many articles out of one issue of a magazine before (it is the only way to file articles for random access!)

Peter Head 28 Park Gate, Mount Avenue, Ealing, London W5 1PX

```
 LIST
   10 REM  APPLE INTEGER BASIC
   20 REM  WON'T YOUR BASIC DO THIS?
   30 REM  THEN GET A BETTER ONE!
   40 ARCHAEOPTERYX 1
   45 ARCHAEOLOGIST 2
   50 PRINT ARCHAEOPTERYX
   60 PRINT ARCHAEOLOGIST
   70 END

 >RUN
 1
 2
```

Reader base

Congratulations on getting it going. Your first number has set the standard which we had come to expect and I am sure that you will attract your usual and a growing following.

E P Hawthorne River Cottage The Riversdale, Bourne End, Bucks

Editor's note

Edward Hawthorne is the author of *The Management of Technology* published by McGraw Hill (ISBN 0-07 084512 3)

The new vehicle

Congratulations on the launch of *Computer Age*. A new vehicle for authoritative comment on computing matters can only be to the benefit of computer users — an ever widening category of people in these days of swift technological advance.

Frederick Walker, Linden Marketing & Communications Limited, 61 St James's Road Croydon CR0 2US

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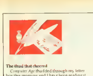

The thud that cheered

Computer Age thudded through my letter box this morning and I have been reading it with great interest. Initial reaction — very favourable. Indeed, with your permission I would like to include part of Gil Filbey's article on FORTH with our documentation for the FORTH package.

In conclusion he suggests that readers nag software distributors to handle it. They really don't need to as we have been selling it for three months, and in fact the implementation he was using by Programma International is distributed in Europe by Petsoft.

Julian Allason, Petsoft, Newbury, Berkshire

The interface

We welcome the appearance of *Computer Age*. There are journals of computing, education, medical education, psychology, politics, etc, which form an ever increasing list of periodicals. Contributors to all of these publications use computers or are involved with them and are aware of the social implications of this modern technology. The regrettable fact is that people are hard pressed to read the journals in their own field; they generally publish in the periodicals of their own major discipline and very rarely venture into print outside their own conventional press. *Computer Age* in its first edition has brought together material from diverse sources. The introduction of an interface journal is greatly appreciated and we hope all readers and contributors will benefit form the cross fertilization of ideas and developments in rapidly advancing computing and its applied technology.

We employ microcomputers in medical education at undergraduate and postgraduate level. We have met people at conferences and exhibitions who are interested in our work or are involved in similar work in different fields but have not contemplated searching the medical press for details of progress in disciplines in which they are not directly working.

We support wholeheartedly Mr S A Wood when he suggests that joining a local User Group is very worthwhile. A group of this type is a useful forum for the dissemination of ideas and all participants benefit greatly. In the absence of such groups it is not unknown in large academic institutions for several teams to be engaged in similar activities but to be totally unaware of the others' existence.

Carol Schmulian B Sc (Hons) M B Ch B, Gavin N C Kenny, B Sc (Hons), M B Ch B F F A R C S, University of Glasgow, Royal Infirmary, Glasgow G4 0SF

A twofold Interest

Glad to see No 1 of *Computer Age*. I have already responded to two of your advertisers. This is my first occasion of turning to a computer journal, and I read it for applications information.

When buying a car with automatic transmission the last thing I want to know is the theory and practice of how the unit is built and works. All I want to know is what it will do and how to operate it.

The same goes for my readership of *Computer Age*. My own interest is twofold: small business accounts and progress control; data storage and accessibility in a variety of modes and formats. In other words, instant organised availability of stored data and descriptions in various permutations according to the specific application requirement, with the possibility for continuous updating.

I see this as a more efficient alternative to the use of wall charts and reference books in areas such as media planning, forward programming for PR requirements, etc, in relation to the needs of a variety of clients whose requirements include knowledge of trade and technical publications, special features, dates of UK and overseas trade exhibitions, calendars.

Here's looking forward to the next issue.

F K. Peachey MISTC MBNCS Technical Writer, 12 Church Road, Leckhampton, Cheltenham

Pico-Pilot and Nascom owners with T4 (CA, Dec '79)

I have received a number of enquiries from Nascom owners with the extended monitor T4 in their machines instead of the standard monitor T2. Pico Pilot was written for a standard Nascom with T2 and at the time I did not have the T4 monitor. However, I do now have the T4 monitor, and I enclose a list of changes to the original Pico Pilot that will enable it to run under either the T4 or the T2 monitors.

I would recommend T2 users to modify their copy as well because the modifications also extend the use of subroutines.

Change address 0C51 from 33 to 3B
Change address 0C9A from FA to 79
Change address 0C9B from 00 to 0D
Change address 0CD7 from 7D to 7F

An improved version Pico Pilot 2 is now available that allows forward and backward jumps, stores a space at the end of all input to prevent the full stop having to be taken into account in matches, and uses the standard Common Pilot format with the modifier after the operation letter. Details of this and the exam mark handler can be obtained from the school (Please enclose £1 to cover duplication and postage).

Alec Wood, Wirral Grammar School, Cross Lane, Bebington, Wirral L63 3AQ

American newsletter

I would very much appreciate your bringing the attention of your readers to *Computers in Psychiatry/Psychology (formerly MICRO PSYCH)*, a bimonthly newsletter for professionals interested in the use of computers in psychiatry and clinical psychology, now beginning its second year of publication. Addressing itself in an informal scientific style to clinical users of the computer, it has attracted over 300 subscribers, most of whom are using or planning to use computers in their work.

The computer work being carried out by subscribers includes neuropsychiatric and MMPI testing, problem assessment, history taking, biofeedback, computer psychopharmacology consultation, EEG analysis, computerized psychotherapy, the development of mental health information systems, computer assisted instruction, and a study of the behavioral effects of viral infection, to name a few. Many readers are using or planning to use micros or minis for office management functions, including word processing, billing, and record keeping.

Each issue of the 13 page newsletter contains original articles, summaries and reviews of recently published articles and books as well as an ongoing bibliography and a program catalogue. Recent additions include a clearinghouse for information on training and employment opportunities in the field and a review column on hardware.

Subscriptions to Volume 2 can be obtained by sending $15 to:

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Marc D Schwartz, M D, Editor

Keeping it simple

As a potential personal micro user dithering on the edge of the business, trying to get some insight into this mysterious technology, I quickly swooped on your magazine when I saw it on the newsstand.

Trying to find out what I want to know, presented in a form I can understand, has been difficult. Initially I was over awed by the technologicalness of the hardware and the people trying to sell it, and to be able to cut through this smoke screen to find out what computers are really for and how they are used has been an ambition which up to now has shown no sign of being fulfilled. Reading just three articles in issue one of *Computer Age* has given me new hope. It is refreshing to read articles directed at new users that are free from jargon and technicalities (which serve only to cloud the issue).

You say in your brief editorial: People who enjoy computing want to graduate to something more substantial, the higher type of application. Very nice, that, for people who know. Please, though, don't forget the people who *want* to know, and there are probably more of those now than there has ever been.

Arthur Wardell, 43 Oakdale Close, Ovenden, Halifax, W Yorks HX3 5RW

Postscript

I sincerely hope that the other articles in your December issue are more accurate than the comments about mail handling arrangements in Oxford under the heading Decisions by Humans.

Firstly, 1st Class mail posted in Oxford for addresses in Oxford does not take longer to reach its destination than 2nd Class mail. Secondly, all First Class mail posted in Oxford is not sent forward via Reading.

Nevertheless I thank you for your comment that the Post Office employs thousands of intelligent people even if the decisions taken are not those published in the article by David Levy.

A R Gibb, Asst Head Postmaster, Head Post Office, Oxford

CA: Mr Gibb is a clear winner of *The Mighty Micro* by Chris Evans.

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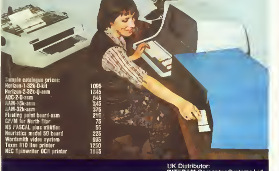

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INTERAM

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INTERAM Computer Systems Ltd.
59 Moreton Street,
Victoria, London SW1V 2NY
Tel: 01-834 0261/2733
Telex: 925859

DISTRICT COMPUTING

England's ~~Smallest~~ Computer Bureau
where users operate the computer themselves

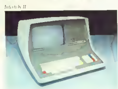
❋ Branch opens in Portsmouth in February

Diablo 3200

This is the Diablo 3200 manufactured by Xerox, which we use in the Bureau It's really well engineered .. we have not had one data error since we started

The Bureau service is essentially local, but if you are not local we can supply the Diablo 3200, together with full accounts packages in the price range of £11,000 for single-user system ideal for small business, to about £25,000 for a multi-user system for the larger business. You could even set up your own 'District Computing'

Intertube II



BUT, THIS IS NOT ALL WE DO:

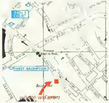
We are distributors for the incredible Intertube II, the really intelligent terminal that cannot become out-dated Hundreds of features all in erasable read only memory so that if needs change so can the terminal

The price is also incredible
ONLY £575.00 plus VAT.

AND ideas that we have developed for ourselves to help our own operations

1 The Decwriter Speed-up Module which can be fitted in minutes to speed up a Decwriter II to 60 cps or with a bit more time to 120 cps
Complete module with fitting instructions £25 00

2 *The Golht Re-inking Kit which makes your printer ribbons last for up to 30 times as long*
Including attachments for Decwriter II, Diablo Hi-Type & Diablo Matrix, only. £5 00



174 IFIELD ROAD, LONDON SW10 9AG.

Tel: 01-373 8571